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B. Report of the Plant Pathologist, Mlanje Experimental Station.

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Report of the Director of Agriculture.

PART I.—Agriculture in Nyasaland.

Weather Conditions.

1. The weather conditions in the early part of the 1936/37 season were very variable. Heavy local storms occurred with hail in several districts. Dry periods of twelve to fourteen days were experienced in December in the Lower River and south central areas and in some parts little rain fell till the end of December. In the tobacco areas of the Northern Province, however, rains were general and well spaced. Weather during January and February was abnormally wet in most central and highland areas. Lower River areas were fairly dry and a definite drought occurred in January in the southern parts. Rainfall was on the high side for good growth of tobacco and other crops during January but the weather in all important areas of the southern province was generally good.

In the Northern Province the month of February was notable for the very meagre amount of sunshine and the number of days of rain which affected tobacco and other crops adversely.

Weather during March was characterised by the very short rainfall in the dry lowland areas, less than half the normal for the month having fallen and most of this fell in the first days of the month. Similar conditions occurred in all northern tobacco areas. In highland areas conditions were more favourable to growth of crops. Ripening of tobacco was however satisfactory during the dry sunny weather although some other crops suffered from the small rainfall.

During April light local showers fell in most central areas early in the month but hardly enough to benefit the cotton crop. Rainfall in the Northern Province was in excess of the small normal. In Lower River areas the rains of April were abnormally localized. In tea areas rains were generally on the short side. Temperatures were generally higher than normal for the latter half of the season.

The usual light local showers marked the end of the growing season in early May. The cool spell at the end of April continued for the first week in May and did some harm to cotton at higher elevations. Rainfall was much below normal in the tea belts. Practically no rain fell in Lower River areas although temperatures were higher than normal.

Weather during June in Lower River areas was dry and sunny with maximum temperatures higher than normal. A few light showers generally were ineffective as far as plant growth was concerned.

Weather during July marking the end of the season generally was dull and cloudy with occasional showers most of which fell in the south. Fair rains for July and August fell in the tea belts.

2. The totals for the six wet months and the six dry months for various localities are shown in the accompanying table.

Station	Zone	Total rainfall November 1, 1936 to April 30, 1937 Inches	Normal for six wet months Inches	Total rainfall May 1 to October 31, 1937 Inches	Normal for six dry months Inches
Port Herald	A	16.43	29.1	2.28	3.6
Port Herald Experimental Station		29.32	28.8	2.54	3.2
Chikwawa		16.47	29.7	3.62	2.3
Cholo	B	40.62	48.8	10.39	8.1
Makwasa		43.47	46.8	11.02	4.4
Nsikisi		45.51	—	—	—
Lipumulo		38.90	—	5.37	—
Mikundi		38.91	—	9.27	—
Upper Mboma		40.59	—	11.03	—

Station	Zone	Total rainfall November 1, 1936 to April 30, 1937 Inches	Normal for six wet months Inches	Total rainfall May 1 to October 31, 1937 Inches	Normal for six dry months Inches
Masambanjati	...	50.11	—	12.53	—
Mlanje	C	68.99	66.6	10.02	14.5
Chitakali	...	81.74	65.5	15.98	12.1
Thornwood	...	66.30	67 8	11.79	11.6
Ruo	...	50.38	53.7	10.41	6.3
Glenorchy	...	60.55	56.2	10.70	10.1
Sayama	...	53.38	56.0	.45	10.5
Lujeri	...	75.82	76.3	19.56	14.3
Chisambo	...	72.33	—	14.87	—
Nalipiri	D	61.04	51.9	11.94	11.0
Blantyre	E	52.18	39.9	2.67	3.3
Limbe Catholic Mission	...	46.29	—	6.03	—
Chingaluwe	...	34.36	42.8	4.70	3.3
Nyambadwe	...	44.00	39.0	1.41	2.9
Chiradzulu Boma	...	42.73	40.0	2.33	2.5
Nyungwe	...	38.42	—	.05	—
Michiru	F	26.24	35.3	—	2.0
Namalanga	G	30.65	29.9	3.41	1.0
Nasonia	...	36.83	36.9	4.24	1.9
Zomba Experimental Station	H	43.68	46.8	4.19	4.6
Zomba Plateau	...	59.26	—	7.30	—
Likwenu	...	48.30	—	2.43	—
Police Headquarters	...	42.15	41.9	3.84	1.8
Domasi	...	67.36	52.7	1.29	—
Nankunda	...	41.34	—	3.55	—
Malosa	...	45.90	—	1.47	—
Mbidi	I	25.81	35.8	—	1.5
Makwapala Experimental Station	...	27.77	34.0	.56	1.5
Mwanza	K	30.58	37.2	3.45	.6
Liwonde	L	22.93	31.7	1.04	1.1
Bilila	...	—	28.0	—	.7
Mandimba	M	26.72	34.0	—	.3
Namwera	...	35.52	42.2	.96	.3
Chipunga	...	38.98	35.0	1.46	.8
Fort Johnston	N	24.09	29.4	.80	1.2
Monkey Bay	...	26.80	29.2	.50	.9
Malindi	...	17.12	—	—	—
Golomoti	...	—	29.5	—	.1
Ncheu	P	38.98	37.0	.43	.9
Likuni	S	30.28	32.9	1.70	1.5
Chimvua	...	27.18	—	.55	—
Lilongwe	...	28.57	32.7	1.68	.8
Nathenje	...	37.69	—	1.58	—
Mpali	T	27.85	—	—	—
Dowa	...	32.0	33.1	1.37	.7
Fort Manning	...	31.96	39.8	.92	2.5
Domira Bay	U	32.60	31.0	.48	.1
Dedza	V	40.89	39.7	.43	2.2
Kasungu	X	41.51	29.1	.64	.3
Mzimba	...	29.36	31.7	.56	.2
Kota Kota	Y	50.46	48.2	.61	2.0
Chinteche	Z	44.48	62.9	5.59	5.1
Livingstonia	...	73.01	57.5	4.26	6.2
Karonga	...	42.24	52.3	4.73	2.8
Salima	...	46.05	—	.30	—
Glengary	...	38.92	—	9.70	—

3. European production and acreage of the principal crops over the past three years are shown in the following table. Weights are given in long tons of 2,240 lbs.

	1935		1936		1937	
	Acres	Yields	Acres	Yields	Acres	Yields
Tea	16,054	5,730,704 lb.	16,346	7,372,316 lb.	17,112	14,466,592 lb.
Coffee	995	1,605 cwt.	336½	533¼ cwt.	566	510 cwt.
Tobacco	6,144	2,112,096 lb.	7,349¼	2,663,360 lb.	6,862	2,714,208 lb.
Sisal	9,785	—	1,547	8,200 cwt.	3,952	6,160 cwt.
Cotton (lint)	2,067	2,016 cwt.	1,997	1,920¾ cwt.	949	1,006 cwt.
Rubber	1,300	159,936 lb.	1,300	1,607 cwt.	1,300	1,685 cwt.

4. Native production and numbers of growers of the two principal crops, *viz.*, cotton and tobacco, are shown below.

	1935		1936		1937	
	No. of growers	Amount sold	No. of growers	Amount sold	No. of growers	Amount sold
Cotton (seed cotton)	70,199	11,237 tons	66,159	6,381 tons	74,845	5,745 tons
Tobacco	49,529	4,594 tons	66,602	6,170 tons	86,053	6,582 tons

Cotton growers refer to Crown land only; figures of private estate (tenant) growers are not known.

5. The exported amounts and values of the various items of agricultural produce and of raw materials are given for the past three years in the table that follows.

	1935		1936		1937	
	Amount	Value £	Amount	Value £	Amount	Value £
Capsicums and chillies	47,869 lb.	598	12,129 lb.	151	3,077 lb.	38
Coffee	603 cwt.	1,127	337 cwt.	628	908 cwt.	2,051
Maize and maize flour	20,185 lb.	23	1,203,513 lb.	1,345	1,171,005 lb.	1,307
Potatoes	113,960 lb.	477	83,279 lb.	335	39,588 lb.	159
Tobacco	10,168,641 lb.	296,929	13,391,541 lb.	390,587	14,536,933 lb.	423,994
Tea	6,042,532 lb.	223,876	7,706,088 lb.	256,870	8,816,788 lb.	326,037
Beeswax	92 cwt.	445	232 cwt.	1,083	320 cwt.	1,492
Cotton (lint)	3,685 tons	204,850	2,375 tons	133,007	2,066 tons	105,722
Cotton seed	1,183 tons	2,366	1,679 tons	3,357	895 tons	2,440
Fibre (all kinds)	355 lb.	1	418 tons	3,346	879 tons	12,900
Groundnuts	20 tons	103	—	—	—	—
Rubber	131,760 lb.	549	206,535 lb.	861	203,175 lb.	3,449
Strophanthus	9,646 lb.	964	16,191 lb.	1,619	24,674 lb.	2,467
Rice	250 lb.	1	—	—	1,235 lb.	6

The most notable increases of exports during 1937 were in tea, tobacco and fibre.

In the case of tea, the increase of 14.4 per cent. was due to improved yields per acre, and the coming into bearing of new acreages. The increase in tobacco production was due to a large increase in the number of registered native growers, amounting to increases of 36.6 per cent. in the Northern Province and 19.6 per cent. in the Southern Province. The increase in the total tobacco crop was only 8.6 per cent. however due largely to reduction in acreage per grower (see also report on native-grown tobacco for 1936-37 season issued by the Native Tobacco Board). The increase in fibre was due to the re-opening of estates in lower river areas in 1936 and increased cutting rendered possible by improved prices in 1937.

The production of cotton was again unsatisfactory being less than in 1936. The main reason for this lowered production was the high incidence of Red Bollworm. This is referred to fully in the report of the Entomologist (Appendix A).

The average prices paid for native tobacco were considerably lower than in 1936, due to the lowered quality of the crop. An attempt is made to control the amount of native dark tobacco produced according to market conditions but in the year under review some over-production of certain types and grades could not be avoided, and any such attempt is rendered difficult owing to the fact that the probable production on private estates is not known.

6. The total figures of tobacco production for 1937 show an increase in comparison with the figures of the previous year.

The actual figures are given in the following table along with the 1936 figures.

Production	1936		1937	
	lb.	lb.	lb.	lb.
Flue-cured ...	2,109,128		2,292,752	
Fire-cured ...	472,808	2,663,360	325,360	2,714,208
Air-cured ...	81,424		96,096	
Native Fire-cured ...		13,821,718		14,742,603
		16,486,078		17,456,811

The increase in production was reflected in an increase of exports.

Exports	1936		1937	
	Amount lb.	Value £	Amount lb.	Value £
Flue-cured ...	1,608,079	46,903	1,876,905	54,743
Fire-cured ...	11,001,797	320,886	11,398,110	332,445
Air-cured ...	781,665	22,797	1,261,918	36,806
	13,391,541	390,386	14,536,933	423,994

Stocks of Nyasaland tobacco stood at 31,459,002 lb. on December 31st, 1937, being 2½ years supply on the usual basis. Consumption of Nyasa tobacco during 1937 amounted to 12,523,176 lb. being an increase of 72,915 lb. on that of the previous year and representing 24 per cent. of all Empire tobacco consumed. The latter figure compares with 26.8 per cent. for 1936.

Exports of tobacco from Nyasaland in 1937 amounted to 8,990,322 lb. of leaf and 5,546,611 lb. of strips, which are practically equal to the imports into the United Kingdom.

7. *European.*—Acreages and yields are given by districts in Appendix I. The crop was disposed of as follows:—

	Flue-cured lb.	Fire-cured lb.	Air-cured lb.	Total lb.
Sold locally ...	2,042,432	287,840	82,432	2,412,704
Exported direct ...	107,072	33,936	2,464	143,472
Left on hand ...	143,248	3,584	11,200	158,032

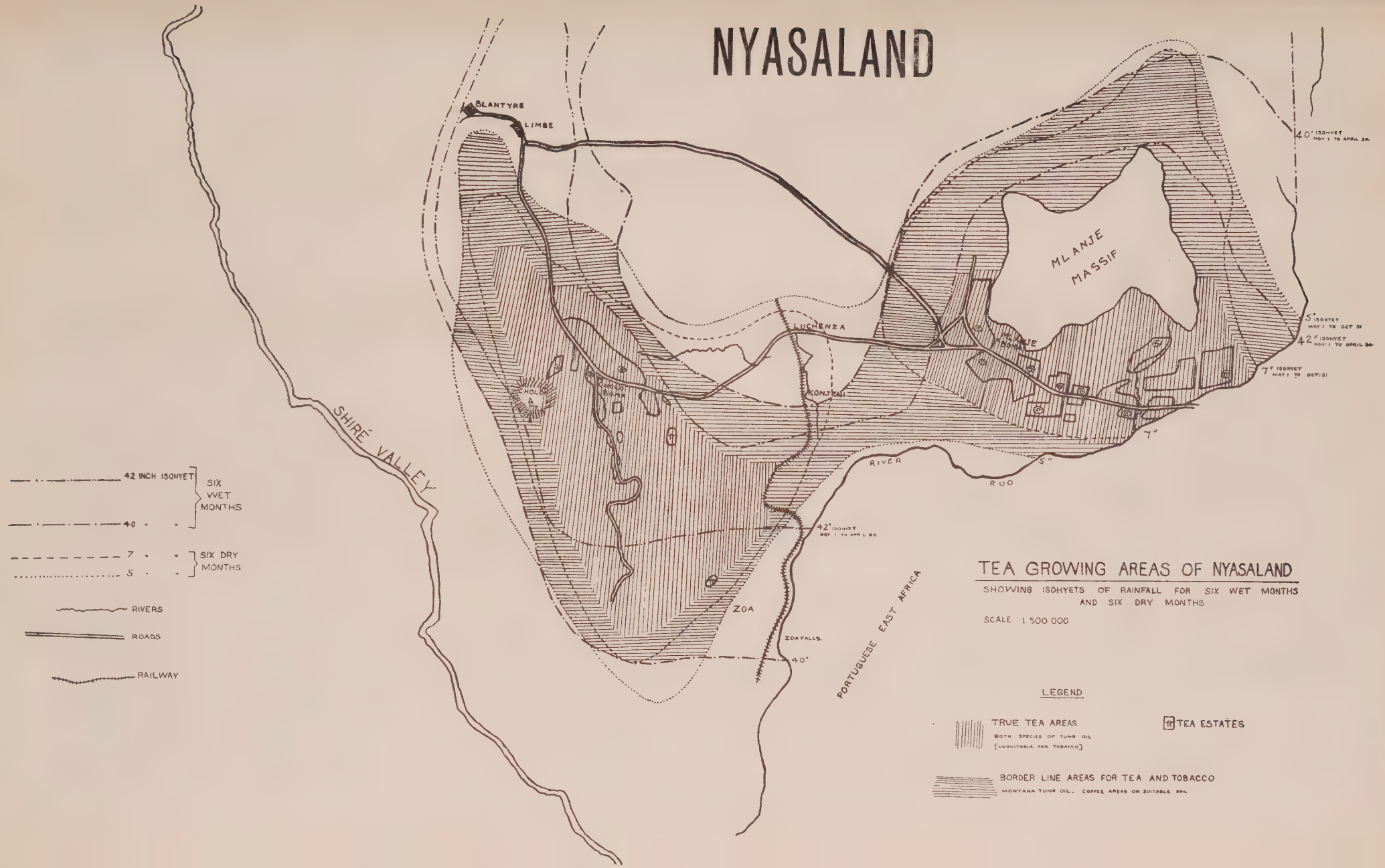
In comparison with 1936 the figures are as follows:—

	1936 lb.	1937 lb.
Sold locally ...	2,200,016	2,412,704
Exported direct ...	215,936	143,472
Left on hand ...	247,408	158,032

European tobacco occupied 6,862 acres as compared with 7,349 acres in 1936 while production totalled 2,714,208 lb. as against 2,663,360 lb. in 1936. The state of the industry was such that Government found it expedient again to give advances to planters during the 1937 season. The 1937 season was not financially favourable to European growers and it is somewhat alarming to note that many of these growers are still attempting to produce bright tobacco in areas where the climatic conditions are usually quite different to those prevailing during the average growing season in areas in which successful bright tobacco production is general. It is computed that nearly 25 per cent. of these European growers are planting in unsuitable or "border line" areas near the tea belts. The map published opposite indicates areas suited to tea and unsuited for tobacco.

8. *Native* In the Northern Province as has been seen, the season was not good and the quality of the crop generally left much to be desired.

The average amounts produced per grower on native trust land were 136 lb. in the Northern Province and 230 lb. in the Southern Province. The number of registered crown-land growers were respectively 58,878 and 12,465, these figures representing increases of 36.6 and 19.6 per cent. in comparison with the 1936 figures. The amounts of dark tobacco purchased from Native Trust land and private estate growers are given under provinces in the following table.


NYASALAND
BLANTYRE
LIMBE
SHIRÉ VALLEY
MLANJE MASSIF
LUCHENZA
MLANJE BOMA
KONJANI
RIVER
RUO
ZOA
ZOA FALLS.
PORTUGUESE EAST AFRICA
40" ISOHYET NOV 1 TO APRIL 30
5" ISOHYET MAY 1 TO OCT 31
42" ISOHYET NOV 1 TO APRIL 30
7" ISOHYET MAY 1 TO OCT 31
42 INCH ISOHYET
40
SIX WET MONTHS
7
5
SIX DRY MONTHS
RIVERS
ROADS
RAILWAY
TEA GROWING AREAS OF NYASALAND
SHOWING ISOHYETS OF RAINFALL FOR SIX WET MONTHS AND SIX DRY MONTHS
SCALE 1 500 000
LEGEND
TRUE TEA AREAS
BOTH SPECIES OF TUNG OIL [UNSUITABLE FOR TOBACCO]
TEA ESTATES
BORDER LINE AREAS FOR TEA AND TOBACCO
MONTANA TUNG OIL. COFFEE AREAS ON SUITABLE SOIL

	Northern Province lb.		Southern Province lb.
Native Trust land	7,985,027	... ...	2,871,616
Private estates	2,654,975	... ...	1,230,985
	10,640,002	... ...	4,102,601

The total figure for the dark tobacco crop produced by native growers was thus 14,742,603 lb. The corresponding figure for 1936 was 13,821,718 lb.

The district details of Crown-land tobacco sold in the two Provinces are given below. The figures for the 1936 crop are quoted for comparison and decreases and increases are shown.

NORTHERN PROVINCE

	1936 lb.		1937 lb.		lb.
Ncheu	306,289	... ...	219,551	—	86,736
Fort Manning ...	139,305	... ...	208,020	+	68,715
Lilongwe	4,996,903	... ...	5,190,590	+	193,687
Dowa	2,466,352	... ...	2,366,866	—	99,486
	7,908,847	... ...	7,985,027	+	76,180

SOUTHERN PROVINCE

Mlanje	1,215,565	... ...	1,368,423	+	152,859
Cholo	18,900	... ...	30,408	+	11,508
Blantyre	307,100	... ...	367,892	+	60,792
Chiradzulu	798,785	... ...	861,036	+	62,251
Zomba	217,464	... ...	216,212	—	1,252
Upper Shire	58,899	... ...	27,645	—	31,254
Total ..	2,626,712	...	2,871,616	+	254,904
Grand Total ...	10,525,559	...	10,856,643	+	331,084

The buying stations of the Native Tobacco Board in the Northern Province opened on May 25. Buying in the Southern Province commenced a few weeks earlier. Buying licences number 87 in all. The amounts purchased at the buying stations were as follows.

	lb.
Nsaru	1,780,105
Lombadzi	972,680
Nathenje	2,437,805
Mponela	2,366,806
	7,557,456

Purchases in the uncontrolled areas of Fort Manning and Ncheu amounted to 427,571 lb.

9. Weather during the seed bed period was favourable to good growth of young plants and practically no disease was seen. Some plantings were made in southern areas in November. In December in northern areas rains were general and well spaced, although some hail occurred. Dry periods occurred during this month in southern areas followed by some heavy storms. Planting out in the Southern Province was however generally completed by the end of the month and fully half the area in the Northern Province supplied with good plants.

Rainfall was on the high side for good growth of tobacco during January but weather improved during February in all important areas of the Southern Province. Topping was general during February. In Chiradzulu and Western Mlanje harvesting commenced on February 8. In the Northern Province the month of February was notable for the very meagre amount of sunshine and the number of days of rain. The crop suffered in the western and northern areas although little disease could be seen. Weather during March was characterised generally by very short rainfall, less than half the normal for the month falling mostly in the first few days of the month.

Ripening was however satisfactory during the dry sunny weather and the crop in northern areas was the soundest seen for some years. Good quality leaf was harvested in Nkumba, and Nazombe, Mlanje, in Kuntumanji and Mwambo in Zomba and in Lunzu, Blantyre, although the percentage of long wrappers was low.

The dark crop in the Northern Province benefited considerably both in the later ripening and during curing from the rains of early April. Barn accommodation was however strained everywhere by much of the later crop ripening all at once. 70 to 80 per cent. of the crop was harvested by the end of April and the remainder of the crop harvested and cured during good weather conditions during May. To sum up, the conditions during the season led to the production of leaf in southern areas of quite fair quality and to the production of leaf in northern areas which was early on characterized by lack of texture and paucity of long wrappers but later on by an improvement in quality and length.

Cotton.

10. *Native.* It has already been mentioned that the production of native grown cotton decreased and the reasons have been gone into elsewhere.

In the Lower River the crop amounted to 3,001 tons of seed cotton, a decrease of 35.5 per cent. from the 1936 figure. In the central area of the Southern Province, the production was 860 tons as against 657 tons in the previous year, while in the area between northern Ncheu and Kota-Kota production increased from 984 to 1,657 tons of seed cotton. The production of cotton on crown-land inclusive of 227 tons in North Nyasa, was thus 5,745 tons. Private estates accounted for 846 tons, and the total for the country was therefore, 6,591 tons; the figure for 1936 was 7,263 tons. Export amounted to 11,572 bales; the 1936 figure was approximately 13,301 bales.

The average price for No. 1 grade was 1.039d., for No. 2 .284d. and for No. 3 .225d. It is estimated that the sum of £49,109 was paid to crown-land growers and that of that sum £46,772 was paid for No. 1 grade. The production factor per pound of seed issued was 2.61 in the Lower River, 4.47 in the central part of the Southern Province and 5.48 in the area of the northern extension of the railway from Ncheu to Kota-Kota. The percentage of No. 1 grade in the crown-land crop was 83.91.

Details of crown-land and private-estate seed-cotton production by districts are as follows:—

Southern Province	tons	Northern Province	tons
Lower Shire ...	2,123	Ncheu	330
Chikwawa	1,167	Dedza	456
Cholo	335	Dowa	691
Mlanje	68	Kota-Kota	402
Central Shire ...	416	North Nyasa	227
Blantyre	110		2,106
Chiradzulu	—		
Zomba	—		
Upper Shire	161		
South Nyasa	105		
	4,485		

11. *European.* European production of seed cotton amounted to 151 as against 295 tons in 1936.

Tea.

12. The tea industry continued to expand towards its limit of 17,700 acres under the restriction scheme. The acreage planted during 1937 was 301, and the total at the end of the year was 17,112 acres of which 8,881 acres were in Mlanje and 8,251 acres in Cholo. Production of tea rose from 7,372,316 lb. in 1936 to 14,466,592 lb. in 1937 while exports, as already noted, increased by 14.4 per cent. The acreage under plucking was 14,666. The industry is still busily engaged in consolidating its position in view of the approach of the end of the present five-years period of restriction in March, 1938.

Investigations were continued at the Mlanje Experimental Station and on estates on fertilisers, methods of pruning and plucking and on Armillaria root disease, and further investigations connected with deficiencies of minor elements affecting fermentation were made. These are referred to more fully in the reports of the Plant Pathologist, Appendix B, and the Assistant Agricultural Chemist, Appendix C.

Coffee.

13. The European acreage under coffee continued to shrink, figures for the past 3 years are given below.

	Total acreage	Production cwt.	Amount exported cwt.
1935 ...	995 ...	1,605 ...	603
1936 ...	837 ...	533 ...	168
1937 ...	566 ...	510 ...	173

It must be accepted that most of the areas in which coffee has been planted are unsuitable for this crop owing to the long dry season. White stem borer also reduces the life of the tree. There are however small areas in the Cholo hills where a greater rainfall is experienced from May to October, in one of these areas, Masambanjati, some success is being obtained by natives in growing coffee under the supervision of the Department.

Tung Oil.

14. Plantings of Tung Oil are increasing rapidly the 624 acres planted in 1936 increasing to 1,677 acres in 1937. *Aleurites montana* continues to form the great majority of plantings owing to the fact that this variety is generally easier to establish and grows much more rapidly than *A. Fordii.* It is however at present uncertain whether this will finally prove to be the most satisfactory variety from a commercial point of view and this question is under investigation. A bulletin was prepared and issued as the result of work on *A. montana* at the Zomba Experimental Station.

Sisal.

15. Owing to the improvement in the price of this commodity cutting, which recommenced in 1936 on the two existing estates, increased in 1937 and exports were more than double those of the previous year.

Native Food Crops.

16. Satisfactory yields of maize were obtained in the Mlanje and Cholo areas, parts of the Lake Shore and of the northern districts, but in the Lower River areas ill distributed rainfall resulted in low yields. In parts of this area flooding also reduced yields and the high level of the lake reduced the amount of land available for planting.

Yields of sorghums and millets were generally good particularly in the lower river though the acreage of the former now planted was reduced during the period of locust infestation and is still considerably less than formerly.

No serious shortage of food occurred though there was the normal annual shortage in the lower river area.

Although seed stocks of groundnuts and beans were inadequate owing to overselling the crop production of these crops increased. Little rosette disease in groundnuts was reported.

Root crops, cassava and sweet potatoes yielded well but there is considerable scope for an increase in the cultivation of such crops in areas where the staple foodstuff is maize.

The production of Soya Beans increased somewhat but this crop is not appreciated as a foodstuff and growers prefer to regard it as a cash crop.

Issues continued to be made of seed of improved varieties from experimental stations, the largest issues being of groundnuts and maize.

Pests and Diseases.

(See Appendices A and B).

17. *Locusts.* The Red-winged locust, *Nomadacris septemfasciata,* was again the only species recorded in the Protectorate during the year. For the second year in succession breeding was confined to the southern half of the country, mainly along the Shire River valley and the Bwanje valley. Tne heaviest infestation occurred in parts of the Chikwawa district but hoppers were absent in the Port Herald area. The amount of damage done by hopper bands was small except in the Kota-Kota district.

The first flying swarms of the 11th generation appeared on March 10th in the Lower Shire district and by April flights were general. The usual movement to higher elevations occurred during May and continued throughout June, and one or two swarms proceeded northwards.

Increased movement of swarms was noted in September and by October a northerly trend of flight could be observed from the Lower Shire and Chikwawa districts. In November the breeding colouration appeared and some southerly movement towards lower areas were noted, but after December 5th no swarms were reported and the Protectorate appeared to be practically free of locusts. No hoppers appeared in December or January. It is not known what became of the swarms at the end of the year. No reports of the death of swarms from disease or after oviposition were received and there is no indication as to what became of them.

18. *Crop pests.* No serious outbreak of crop pests occurred during the period under review with the exception of Red Spider on tea, of which there was a serious outbreak in October and November over an unusually large area, and Red Bollworm on Cotton.

19. The Red Bollworm *Diparopsis castanea*, appears to be the main limiting factor in cotton production over the important cotton producing areas and has been more than any other factor the cause of the reduction in cotton production over the past two years. The necessity for a "dead season" when there exists no cotton to carry the pest over is not yet properly appreciated and the uprooting of the crop required under the cotton rules is far from complete. Until there is a considerable improvement in this respect neither improved cultivation or seed nor the adoption of more suitable dates for planting can bring about the effects which might be expected of them.

20. *Crop diseases.* No serious outbreaks of diseases were reported in 1937. The Plant Pathologist continued his investigations into Armillaria Root disease which gives considerable trouble in Tea plantations and undertook further work in connection with Citrus Mottle. He has shown that the disease is probably due to a Zinc deficiency and that it may be treated successfully with a Zinc Sulphate and Lime Spray.

Advisory Bodies and Policy.

21. No meeting of the Board of Agriculture was held during the year under review.

22. The Native Welfare Committee continue to advise Government on matters affecting the welfare of the native population and to co-ordinate the policies and activities of the different Departments concerned with such welfare. This Committee appointed during the year an Agronomic Sub-Committee consisting of the Director of Agriculture, Chairman, the Conservator of Forests, Chief Veterinary Officer and Mr. R. C. Allan with the following terms of reference.

1. To set out principles for the better utilisation of the true agricultural lands.

2. To set out principles for the economical utilisation of the poorer classes of land, in relation to agriculture, the grazing of stock, and forestry.

3. In regard to hill-slopes, to determine:—

(*a*) The maximum gradient on which the cultivation of crops can reasonably be allowed, assuming that measures for soil retention are adopted by the cultivation *e.g.* terracing, bunding, etc.

(*b*) The best means of ensuring that gradients steeper than the maximum in (*a*) are preserved under natural vegetation.

4. To determine the best means of furthering a policy of preserving or creating windbreaks on all extensive areas used for agriculture.

5. To investigate means of furthering, in all regions, the policy advocated by Government of "early controlled burning" of inflammable grasses and ground vegetation.

6. To investigate means of alleviating congestion of population where over-crowding is already proved, involving, if necessary, some redistribution.

7. To investigate means of alleviating the evils brought about by over-stocking.

8. To institute enquiries generally, as to the adequacy or otherwise, of suitable land for maintaining the present population and the normal increase which may be expected.

9. To make recommendations in regard to surreptitious settlement on the land by native immigrants.

Part II—Work of the Department of Agriculture, the Empire Cotton Growing Corporation and the Native Tobacco Board.

23. Agricultural work in the Protectorate falls under the control of three organisations viz.: the Department of Agriculture, the Empire Cotton Growing Corporation and the Native Tobacco Board. The latter is responsible for all work in connection with tobacco grown on Native Trust Lands. The Empire Cotton Growing Corporation undertakes investigational and experimental work in connection with cotton, including breeding, the testing of strains and varieties, culture, pests and diseases and in conjunction with this work investigates such matters as suitable rotations and alternative crops for the cotton areas. Other agricultural work falls under the Department of Agriculture.

The closest possible touch is maintained between the three organisations. The Director of Agriculture is Chairman and the Assistant Director a member of the Native Tobacco Board and responsible for the executive work of the Board, and close personal touch is maintained between officers of the Department and those of the Empire Cotton Growing Corporation.

Experiment Stations.

24. Experiment stations are maintained by each organisation and on some of these stations work is undertaken in conjunction with the other organisations.

Agricultural Department Stations.

25. *Port Herald*, vide Appendix E. Owing to shortage of staff this station had to be left in charge of a native capitao for some three months, and it was therefore not possible to maintain a full experimental programme. Time of planting of cotton trials did not give results of any value owing to insect attack which was naturally heavier on the later planted plots.

A cotton strain trial carried out by the Empire Cotton Growing Corporation staff showed no significant difference between the ordinary bulk strain and five other strains from Domira Bay.

Groundnuts gave poor yields, particularly the later plantings, in the time of planting trials and it is clear that in this area early planting is necessary to obtain any reasonable crop. Rosette disease was less pronounced where close spacing was employed.

Experiments on the dimba sub-station failed owing to early and persistent heavy floods.

26. *Makwapala*, vide Appendix G. As at Port Herald shortage of staff prevented a full experimental programme from being carried out. In any case, as pointed out in the last report, this station has served its purpose for experimental work and will now be used mainly for seed multiplication and experiments in restoration of fertility. Some work was done on varieties of Cassava, interplanting of maize and sorghums, the use of two year old cotton seed, pigeon pea, Castor oil, Sugar cane and Rice. Grafted Citrus trees were established. The station is now treated as a sub-station of the Zomba Experimental Station.

27. *Masambanjati*, vide Appendix E. The native coffee plots controlled from this station have commenced to bear and 3 tons of coffee were produced. The observation plots on the station with coffee under different shade trees and with different cover crops also commenced to yield but no useful figures can as yet be given.

28. *North Nyasa Experiment Station.* At this station the main investigations were connected with the time of planting of cotton and variety trials of cotton. These were all carried out in conjunction with the Empire Cotton Growing Corporation staff.

29. *Mlanje Experiment Station*, vide Appendix B. This station, situated in the tea area, is almost entirely concerned with that crop. Plots on a nearby estate are also used to extend the work. Investigations into fertilisers, pruning methods, intensity of plucking and various other aspects of tea culture were carried out.

Native Tobacco Board Stations.

30. *Zomba Experiment Station*, vide Appendix G. This station is financed partly by the Native Tobacco Board and partly from Government funds. In addition to the specialised tobacco work it serves as a general experiment station. Work carried out includes the selection and

production of tobacco seed, soil conservation and improvement, rotations, food and other crops, and compost making. It serves also as the main station for plant introductions and trials and in addition to small grass plots on the station a large scale experiment on the establishment of introduced grasses under natural conditions is being undertaken by the officer in charge on Zomba mountain.

31. *Lilongwe Experiment Station*, vide Appendix H. This station situated at Likuni with a sub-station at Chimvua is also financed by the Native Tobacco Board but serves the needs of general agriculture in the important tobacco area around Lilongwe. The main investigations in progress were, the effect of potash on dark fired tobacco, rotation experiments, maintenance of fertility and a Soya bean variety trial. Cotton experiments are also carried out by the Empire Cotton Growing Corporation staff on this station, the main object being to find a variety suited to the higher elevations.

32. *Empire Cotton Growing Corporation*, vide Appendix I.

Nkwali, Domira Bay. The main work at this station is on cotton and includes a large amount of selection work and comparison of different strains and varieties, cultivation and manuring experiments and pest control methods. Experiments with rotation crops were also carried out including selection and time of planting trials with maize, and strain trials of groundnuts, sorghums and pulses.

District Work.

33. District work is carried out by the staff of the Department and of the Native Tobacco Board. In areas in which native dark fired tobacco is an important crop, a comparatively large supervising staff is essential to supervise the growing and curing of the crop and this is maintained in these areas by the Board. In addition to tobacco work the Board's Supervisors attend to the general agriculture of the district and as the result of the efforts of an adequate staff a steady improvement in methods of agriculture and land utilisation is noticeable. In areas not producing tobacco departmental staff are insufficient in numbers to undertake the work desirable and progress is slower. The work carried out may be classified under the broad heads of :—

(*a*) Soil conservation and improvement, including anti-erosion terracing, the manufacture and use of compost, and efforts to secure better cultivation.

(*b*) Crop improvement, by attention to rotations, balance of cropping, supervision of dates and methods of planting and harvesting, the issue of new or improved seed and the encouragement of seed selection.

(*c*) Supervision of marketing, mainly in the case of tobacco and cotton.

(*d*) Advisory work.

(*e*) Experiments and Demonstrations.

Both the Department and the Board are handicapped in their district work by lack of trained Native Agricultural Instructors. A number of Capitaos are employed, but these have only had such instruction in Agriculture as it has been possible for Agricultural Officers and Supervisors to give them in the ordinary course of their duties. Provision is made in the 1938 estimates for the establishment of two Schools to train such instructors and when a number of men with a sound grounding in elementary agriculture can be put out in the district from these Schools it is confidently anticipated that efforts to improve native agricultural practice will be more rapid and effective than they can be at present.

35. A number of demonstration plots are in existence in different areas on which are demonstrated rotation of crops, composting, improved or selected seed, improved methods of cultivation, the prevention of erosion and other practices which it is desired to introduce into native cultivation. A fair amount of interest in these plots is evidenced but the number of natives who try to emulate them is distressingly small unless a good deal of personal propaganda with individuals can be carried out. Occasional natives have been found who are willing to act on the advice of Departmental officers and their own gardens serve as even more valuable demonstration plots than those maintained by the Department since others are more ready to emulate what they see is being done by one of themselves, whereas in the case of a plot maintained by a Government organisation the feeling exists that Government can make use of resources not available to themselves.

Agricultural Survey of the five most Northerly Districts.

36. Work was continued during 1937 on the agricultural survey of the 'dead' north which was financially assisted by a grant of £1,500 from the Colonial Development Fund. The Agricultural Officers of North Nyasa and Kota Kota assisted and rendered interim reports on their respective areas. Messrs. Pryor, Smalley, Williamson and Fenner reported on other areas. The Assistant Director made aerial and ground surveys continuing those previously made by him in 1926. The Entomologist and the Cotton Specialist, Empire Cotton Growing Corporation reported on coffee and cotton prospects in the Ahenga country of North Nyasa. A detailed survey of the Misuku country in North Nyasa has previously been made by Mr. F. Barker when Agricultural Officer, Karonga. Climatic and vegetation surveys were made some time ago by Messrs. Davy and Hornby.

As a result of the above tours and surveys a large amount of information is available on all parts of the five most northerly districts and it is obvious that owing to the great variation of soil and climate which occurs as one passes from any one of the ten recognised agricultural zones to another it will be very difficult to obtain real economic progress in a few years.

The ten zones mentioned are surrounded by large areas which owing to their altitude, the average slope, the generally low fertility or the paucity of the vegetation cover can take no part for some considerable time in assisting economic progress. It is computed that at least two-thirds of the districts in question are covered by such areas of high altitudes covered by grassland downs or by areas of generally low fertility.

The agricultural zones, their approximate elevations and the acreages of land of medium to good quality are as follows:—

	Approximate elevation	Acreages of land suited to agricultural development
1. Karonga-Songwe plain	1550-2000 ...	107,500
2. Vua-Ngara littoral	1550-2300 ...	83,200
3. Ahenga hill areas and foothills of Nyika	3000-4500 ...	56,900
4. Akamanga-South Rukuru plains ...	3500-4000 ...	55,600
5. South-eastern slopes of the Vipya range with Limpasa valley	1600-2500 ...	69,200
6. Highlands of southern Mzimba and northern Kasungu	3000-5000 ...	22,400
7. Highlands of central Kota Kota ...	2500-4000 ...	82,000
8. Lowlands of northern Kota Kota ...	1550-2300 ...	78,500
9. Southern Kota Kota plain	1550-2300 ...	3,840
10. Main central Kasungu plain ...	3250-3750 ...	171,000

Entomology and Plant Pathology.

37. These matters have been referred to earlier in this report and particulars are given in Appendices A and B.

Botanic Gardens and Plant Introduction Station.

38. The gardens and grounds below the Old Residency which form the above station have been improved during the year by the removal of unsightly trees and the increase in organic matter by applications of compost to the inferior red soils.

39. Introductions during the year were:—

New Zealand flax

Citrus trees from South Africa

Pineapples of improved strains from South Africa

Schinus molle—Pepper tree

Derris elliptica from Malaya and the East African Research Station, Amani, Tanganyika Territory.

Soil Science and Chemistry.

40. The usual amount of field work accompanied by the examination of profiles and mapping to show distribution of soil groups and series was carried out during the year by the specialist officers concerned, especially in connection with the agricultural survey of the Northern Province.

Ordinary routine work was carried out during the year. Numerous analyses of samples of milk to investigate changes in composition during the seasons were made.

The usual tests for arsenic were carried out in suspected cases of dip-poisoning of cattle and large amounts of deci-normal iodine were prepared for the Veterinary Department.

Publications.

41. Bulletin No. 4, Agronomic Series, "The Tung or Mu-oil tree in Nyasaland (*Aleurities montana*)" by A. J. W. Hornby, M.B.E., B.Sc., D.I.C. and A. B. Cormack was issued during the year.

Staff.

42. Dr. W. Small, M.B.E., Director of Agriculture proceeded on leave on February 26 pending retirement on October 7; he was succeeded with effect from September 30 by Mr. D. L. Blunt, who arrived in the Protectorate on November 24. The Assistant Director of Agriculture and Chemist; the Assistant Chemist; Mr. F. Barker and Mr. R. W. Kettlewell, Agricultural Officers; the Office Superintendent and Secretary, Native Tobacco Board; and Major D. N. Smalley, temporary Agricultural Supervisor; were on leave during the year. Mr. A. P. S. Forbes, Agricultural Officer, arrived on December 26 on first appointment. Messrs. J. F. Henning, C. W. Coombe, A. C. Williamson and J. C. Stiven, were appointed locally as temporary Agricultural Supervisors with effect from October 7, 25 and December 1 and 1 respectively. Capt. A. J. W. Hornby, M.B.E., Assistant Director of Agriculture and Chemist, acted as Director of Agriculture from February 25 to November 26; Capt. C. Smee, M.C., Entomologist, acted as Assistant Director of Agriculture from January 1 to February 9 and from February 25 to November 26; Mr. G. T. Stafford, Senior Clerk, acted as Office Superintendent and Secretary, Native Tobacco Board from June 27 to December 31.

Of the Native Tobacco Board staff, Mr. R. E. Jackson, Agricultural Superintendent; Messrs. J. W. Guise, F. F. Smithyman, R. J. Sanderson and A. B. Cormack, Supervisors, were on leave. Messrs. J. Hunter, W. Kirk, M. S. Hall and W. D. Lewis were appointed locally as Supervisors with effect from September 1, October 27 and November 15 and 18 respectively. Messrs. L. N. Raynor and J. H. Copland were appointed locally as Junior Supervisors with effect from January 4 and March 3 respectively. Mrs. M. G. Wilbraham and Mr. R. Neil were appointed temporary Clerks with effect from August 4 and November 11 respectively. The employment of Messrs. C. W. Coombe and J. H. Copland terminated on April 30 and September 30 respectively. Mr. J. W. Burton, Supervisor, acted as Agricultural Superintendent during Mr. Jackson's absence on leave.

Native Tobacco Board.

43. The Supervisors employed by the Board continued their work of supervising the planting, cultivation and harvesting and curing of the Native Trust land dark fired tobacco crop together with a small quantity of air cured tobacco produced in the Bwanje valley. Particular attention was given to improvement in methods of topping and curing to meet so far as possible the demands of the market. This work of the Native Tobacco Board staff is of particular importance and no little difficulty since the demands of the market for particular types of leaf are not constant year by year. In certain areas of the Southern Province adapted for its production considerable efforts were made to increase the production of a type of leaf suitable for the West African markets.

During the course of the year a proposal to establish the system of selling tobacco by auction was considered and adopted and the Board's staff were required to make preliminary arrangements to buy the Native Trust Land crop and to place it on the Auction floors. The Board also undertook the building of an Auction Floor at Lilongwe to be handed over to an Auction Floor Company when such company should be formed. These preparations and more intensive supervision of tobacco production involved an increase in the Board's staff which at the end of the year consisted of an Agent and Senior Supervisor, 12 Supervisors, 1 Junior Supervisor, 1 Temporary Supervisor together with 4 more temporary Supervisors paid half by the Board and half by the Department of Agriculture to undertake district work partly on tobacco and partly on other crops.

44. The Board consisted of the Honourable the Treasurer, the Assistant Director of Agriculture, the Senior Provincial Commissioner, the Provincial Commissioner, Northern Province, the Honourable Mr. W. Tait-Bowie, O.B.E., Mr. A. F. Barron, O.B.E. and Dr. I. Conforzi, with the Director of Agriculture as Chairman. The Assistant Director of Agriculture acted as Chairman from February 25 to November 26 in the absence of the Director of Agriculture.

The Board held six meetings during the year at which the major items considered were:—

Scheme for the Establishment of a School for training Native Agricultural Instructors.

Consideration of restriction of tobacco growing.

The Establishment of the Auction system of selling tobacco in Nyasaland.

A bonus plan in connection with tobacco purchase.

Part III. Financial Statements.

45. The following statement shows the 1937 expenditure and receipts of the Department of Agriculture. The Native Tobacco Board statement is in Appendix K.

Expenditure

	Approved estimate		Amount spent		
Personal Emoluments	£		£	s.	d.
European Staff	10,429		9,945	7	3
Native Staff	1,067		1,046	13	5
Other Charges					
Transport	2,101		1,731	2	3
Travelling	13		15	8	3
Passages	933		1,213	7	4
Experimental Work	1,150		1,107	16	2
Distribution of Cotton Seed	1,600		1,062	10	8
Botanic Gardens	45		43	8	3
Contribution to Agricultural Show	120		120	—	—
Treatment of Plant Diseases, Tobacco Pests, etc.	150		28	13	6
Library	50		44	8	7
Tools and Equipment	250		240	13	—
Seeds and Plants	50		39	4	11
Incidentals	20		15	8	11
Uniforms	56		46	16	—
Cotton Seed Stores and Markets	80		90	4	10
Cotton Seed Bags	50		50	—	—
Upkeep of Boat	30		26	16	1
Contribution towards Upkeep of Experimental Stations (E.C.G.C.)	325		325	—	—
Transport (E.C.G.C.)	300		298	16	6
Contribution to Native Tobacco Board	720		720	—	—
Contribution to Native Agricultural Show, Lilongwe	—		12	10	—
	19,539		18,224	5	11
Special Expenditure					
Anti-locust Campaign	250		--		—
Three Tents	68		64	19	5
	318		64	19	5
Grand Total	19,857		18,289	5	4

		Actual Revenue		
Revenue	£		£	s.	d.
Sale of Agricultural Produce	215		354	6	7

Part IV. Summary of Legislative Changes Affecting Agricultural Industries during 1937.

46. The Flue-cured Tobacco Marketing Ordinance, No. 10 of 1936, was repealed and replaced by the Tobacco Marketing Ordinance, No. 17 of 1937. Under the Flue-cured Tobacco Marketing Ordinance of 1936 a Tobacco Control Board was constituted and the Flue-cured Tobacco Marketing Regulations, 1937, were published; the Rules regulated the cultivation and marketing of tobacco by means of registration, permits and licences.

The Tobacco Ordinance, No. 5 of 1926, was amended by the Tobacco (Amendment) Ordinance, No. 16 of 1937. This amending Ordinance provided for the establishment and incorporation of the Native Tobacco Board.

Under the Native Tobacco Board Rules, 1937, the Native Tobacco Board was given power to employ its funds to purchase tobacco by cash from native growers at various Receiving and Buying Stations. Under these Rules the Board was also given power to effect the sale of tobacco by auction and to enable it to do so the Board may establish auction floors and may invest its funds, subject to the approval of the Governor in Council, in any company or partnership formed with the object of carrying on the business of auctioning tobacco. The Board was also given power to erect and/or purchase buildings required for the purpose of marketing tobacco grown by natives and to dispose of any such buildings. It is also laid down in the Rules that no person shall buy tobacco grown on unalienated native trust land from natives except with the written permission of the Chairman of the Board.

Acknowledgments.

47. The Department and the Native Tobacco Board have been generously assisted in their work by the British Cotton Growing Association, the Empire Cotton Growing Corporation, the Nyasaland Tobacco Association, the Nyasaland Tobacco Exporters Association and the Nyasaland Tea Association. To these bodies grateful thanks are tendered for their advice and assistance. Also Administrative Officers, Agriculturists and others who have assisted the work and officers of the Department and the Board.

The opportunity is taken of paying particular tribute to the work of the Assistant Director, Capt. A. J. W. Hornby, M.B.E. Not only was he acting as Director for the greater part of the year but as the chief executive officer of the Native Tobacco Board, on him fell the whole of the planning of the new method of marketing tobacco, a method which he was very largely instrumental in introducing.

Thanks are also due to the Imperial Institute, The Imperial Institute of Entomology, the Imperial Institute of Mycology and Imperial Bureaux for assistance in their particular spheres.

D. L. Blunt,
Director of Agriculture.

Report of the Entomologist.

I was acting as Assistant Director in the early part of the year and again from February to November.

During the year particular attention was paid to the native grown coffee at Masambanjati in the Cholo district and at Nchenachena and Rumpi in the Mombera district; to further investigation of the possibility of cotton-growing in the Kasitu river valley and adjacent areas and to the most suitable planting campaign to adopt in the lake-shore cotton areas of the North Nyasa district.

In June I accompanied Professor J. W. Munro and members of the staff of the Empire Cotton Growing Corporation from Barberton during their visit to Nyasaland in connection with the extension of the work of the Corporation on cotton pests.

Masambanjati Coffee. Full acknowledgment must be made of the valuable assistance given by the District Commissioner, Cholo, in checking undesirable methods of cultivation and eliminating slack and negligent growers form this area.

That well-grown coffee bushes and a properly handled crop will prove remunerative to growers here is shewn by the money received for this year's crop. Owing to variation in age and size of gardens it is not possible to quote an average sum received, but over £65 was disbursed among some 55 sellers: two of whom received over £5 each, six over £3, five over £2 and seven over £1.

The area suitable for coffee is, however, limited and considerable care is necessary to prevent the opening of new gardens on eroded slopes, on wind-exposed sites, or in places so remote from the Department's centre of activity that proper supervision cannot be exercised. Propaganda is required on the employment of cover crops, a practice that does not seem to appeal to the native grower at present, the use of thick leaf-mulch in those gardens that are devoid of shade trees, and the removal of 'buni' and other unsaleable berry from the bushes.

It will be necessary for the Department to continue the supply of good seedlings to replace the thin whippy plants that inevitably occur in small numbers and which will never become profitable bushes.

Nchenachena and Rumpi Coffee. During a visit in October it was encouraging to find that growers here were adopting some form of mulching after many of them had been to see the Department's demonstration plots and had observed for themselves the effect of this practice on the appearance of the bushes during the dry weather. To be fully effective the mulching should have been done much earlier, and it was a little disappointing to find that the necessary energy to complete the work in any one garden—a bare day's work in every case, all the required materials being close to hand—was apparently quite lacking. It is, however, a step in the right direction as such mulching is absolutely essential in this area where no shade trees exist and the dry season may be a long one.

It may be mentioned here that, in view of the natural conditions limiting the expansion of coffee-growing in this area, attention is being given to the furtherance of the production of beeswax throughout the Nyika and Vipya plateaux generally. The matter is still in a very elementary stage, but due to the enthusiasm of the District Commissioner, Mzimba, a small number of the improved type of native bee-hive with queen-excluders, as devised in Tanganyika and Uganda, was constructed and it was hoped would prove successful. It was disconcerting, therefore, to read in the 1936 annual report of the Entomologist of Tanganyika Territory that this type of hive had been abandoned there as being beyond the ability of native workmen to construct with sufficient accuracy to be of value.

Nevertheless the Agricultural Officer is encouraging the production of wax in the areas mentioned and with increased interest on the part of buyers, demonstration in methods of more cleanly refinement of wax will be desirable.

The offer of the Entomologist, Tanganyika Territory, of the temporary loan of a capitao trained in the production of beeswax might well be accepted at a later date.

Kasitu Valley Cotton. In company with Mr. H. C. Ducker of the Empire Cotton Growing Corporation, this area was again inspected in October. The opinion I had reached the previous year and during earlier visits in the current year, that the introduction of cotton-growing in this area was not justified, was confirmed. A separate report was submitted.

North Nyasa Cotton. Both Mr. Ducker and myself hold the opinion that cotton planting in the lake shore area of this district offers some fair prospect of expansion if the crop is confined to the flood lands and sub-irrigated areas, and entirely eliminated as a rain-grown crop. There are also possibilities that artificially irrigated cotton could be grown successfully in certain parts of the area but this matter would require expert investigation.

Any attempt to continue the present practice of growing cotton, both under rainfall conditions and on floodland, must inevitably lead to the existence of cotton plants over the full twelve months of the year. Apart altogether from the increase in general cotton pests that such a planting system will bring about, the presence of Pink bollworm (*Platyedra gossypiella*, Saunders,) in this area, confirmed again on this visit, makes it imperative that there shall be a rigidly enforced *long* dead season and a really thorough clean up of old cotton gardens every year.

Propaganda to limit cotton planting to the floodlands of this area and substituting groundnuts in those parts where rain-grown cotton has been previously planted, has been started by the District Commissioner and the Agricultural Officer.

Crop Pests.

Tobacco. A slight out break of greenfly (*Myzus persicae*, Sulz.) at the Zomba Experimental Station was successfully controlled by a normal strength spray of *Katakilla.* No particularly serious depradation by insect pests was recorded during the year.

Cotton. Confirmation of the presence of Pink bollworm in the North Nyasa district has already been mentioned.

Excessive attack by Red bollworm (*Diparopsis castanea*, Hmps.) appeared to be general through most of the Protectorate, being particularly heavy in certain European-grown cotton on the Palombe plain and in parts of the Ndindi Marsh in the Lower Shire district. In the case of the former area it was stated that cotton had not been grown in the vicinity for a considerable number of years but this is not altogether accurate. Cotton had been grown during the immediately preceding two or three years (if not more) in sufficient proximity to these seriously infested crops to account for the presence of the moth throughout the area, but the intensity of the attack calls for further explanation, possibly connected with the migration of numbers of moths from some considerable distance away.

The destruction in the Ndindi Marsh was particularly unfortunate as the crop there promised extremely well in June but was practically wiped out by August and September—an unusually late period for a heavy occurrence of this bollworm.

A detailed survey of the available data of the climatic conditions in the Lower River districts has shewn that the poor crops of 1936 and 1937 cannot be ascribed to 'time of planting' or to weather conditions alone or together, and the evidence from the Ndindi Marsh in this current year indicates very forcibly that insect pests, of which Red bollworm has been outstanding, have been the main factor.

The crop of 1936, which in the Lower Shire and Chikwawa districts was some 1800 tons *less* than in 1935, was harvested in the season that marked the culmination of the years of intensive propaganda for the commencement of planting as early in December as possible with no limit to the period during which planting could be carried on. As the recorded climatic conditions, with the possible exception of the humidity factor (Annual Report 1936 page 20), shew this year to have been as equally suitable for a good cotton crop as previously, including the immediately preceding year when the record crop was obtained, it is apparent that a serious drop in yield was *already taking place under this planting system* and did not suddenly begin in the current year (1937) when planting, for the first time for several years, was not allowed until the middle of January.

Furthermore the often repeated statement that a drought, or at least a prolonged dry period, occurs regularly in the Lower River districts between mid-January and mid-February is not supported by rain-fall records covering a period of ten years, and in fact the records point to there being a less consistent rainfall earlier in the season than later.

It was pointed out in the last annual report that there had been no true dead season in the Lower River districts as a whole for a number of years, and though a determined effort was made to obtain a close period of six weeks between the uprooting of the 1936 crop and the planting of the 1937 crop it cannot be expected that one such short period could effectively counterbalance the accumulated results of the several previous years.

Cotton must be treated—and strictly grown—as an annual plant, and in a unit of area such as the Lower River districts it is essential that the dead season should be in force at the same time throughout the whole area. The poor crop of 1936 resulted in numerous attempts at evasion of the uprooting rules and as some 1,100 convictions were made under these rules in the Lower River districts alone, even though this figure may be only a small percentage of the total number of growers there, it is permissable to ask how much stand-over cotton escaped detection this year, and more particularly in previous years when supervision could not possibly have been as close. Observations by the staff of the Empire Cotton Growing Corporation in the Domira Bay area confirmed the opinion expressed by the Agricultural Officer in the Central Areas that up-rooting had probably not been carried out as efficiently as was at first believed, and no one, however unobservant, travelling through any cotton area in the off-season can fail to find a number of undestroyed gardens.

All of which goes to show how much the dead season in the past has been a pious hope rather than a fact.

A further contributing cause to the existence of stand-over cotton is the presence of native growers who, probably more for the sake of prestige than for any financial gain they are likely to obtain, employ labour to plant several acres of cotton. For a variety of reasons such cotton is less likely to be properly up-rooted and destroyed at the end of the season than any other. Cases of this kind have occurred through the Bwanje Valley and elsewhere, and in most, if not all, areas, the growing of a larger acreage of cotton than can be properly cultivated by the owner and his family should be actively discouraged.

Under these circumstances unless the grower receives a due monetary reward for any improvement in his crop that results from his adoption of methods urged on him by Agricultural Officers and Supervisors, it cannot be expected that he will give the crop anything but the bare minimum of attention in cultivation or grading, and the maintenance of an effective dead season will never become the regular field practice that it should be but will always remain in the unsatisfactory state of being a matter to be enforced by law and punishment.

In the case of the Lower River districts, also, an active agreement with neighbouring territory for uniform action is desirable for the successful control of cotton bollworms.

In some of the northern areas, Kidney cotton abounds and can be found in most villages and even near isolated huts. As late in the year as October these plants were harbouring large numbers of Red bollworm caterpillars and it is most desirable that Agricultural Officers and Supervisors in the central and southern areas should keep a look out for such plants and have them eradicated in spite of any opposition.

Stainers (*Dysdercus* spp.) were reported to be less in evidence, at any rate in the Lower River districts, than in the previous year. The collection of information on the seasonal behaviour of the arboreal host-plants, *Sterculia*, *Thespesia*, *Adansonia* and others, through Agricultural Officers and their staff has been continued.

The Eumolpid beetle, *Syagrus morio*, Hart., was reported to have done some damage in February to roots of cotton plants in the Livunzu section of the Chikwawa district.

Cereals. A small outbreak of swarming caterpillars, *Laphygma exempta*, F., occurred in part of the Chiradzulu district early in January. It was of no particular importance but it is unusual to record this pest two years in succession.

Tung Nut. The infestation of trees at the Zomba Experimental Station by the scale insect *Aspidiotus hederae*, Vall., referred to in the last report, cleared up in the first half of the year without any artificial control methods being applied. The Eulophid parasite, *Aspidiotiphagus lounsburyi*, Bol. and Paoli, was mainly responsible for this clean up and by the end of the year only isolated scale insects were to be found. The scale has been recorded from Tung Nut trees in the Cholo district and it is probable that fluctuating out-breaks of it will occur from time to time, but it is not anticipated that any serious damage will result.

Tea. Red Spider was again serious, particularly during October and November, and the rapidity of its spread was phenomenal, the areas infected being unusually large. There may have been an early development and distribution of the mites correlated with an exceptional dry spell in April and May, which provided an abnormal number of foci for further development during the usual dry season. Some difference of opinion exists among plantation managers as to the efficacy of colloidal sulphur compared with that of lime-sulphur in controlling this pest. The evidence is conflicting, however, and the writer can only affirm his experience that colloidal sulphur, properly applied, has given good results.

Cockchafer grubs, *Melolonthidae*, did some damage to eighteen months old nursery plants at one estate in Mlanje in August. As the beetles which give rise to these grubs are associated with certain forest trees prevalent in the tea districts, particularly near streams where nurseries are usually sited, attacks of this kind must be expected from time to time about the middle of the year. A mid-year brood of the ordinary cut-worms sometimes appears in tea nurseries at about the same time. Frequent inspection of the nurseries during this period is advised, so that hand-collection of the grubs or cut-worms may be started at the first sign of any damage being done.

Another large brown weevil, *Tetracyphus odontomus*, Chev., must be added to the number of those that have been found gnawing the green shoots of tea bushes, but it is probably of little importance.

Coffee. The White Stem-borer, *Anthores leuconotus*, Pasc., continues to be the most serious pest of this crop. A leaflet in the vernacular giving information about this beetle, methods of checking it and encouraging the eradication of the known wild host plants was issued to growers in the Masambanjati area.

The Cameron or Coffee Bug, *Antestia variegata*, Thumb., has not yet reached a serious status in this area but this insect is a potential pest of considerable importance.

Groundnuts. Attack by the green-fly, *Aphis leguminosae*, Theo., and the consequent transmission of rosette disease did not appear to be as heavy or as widespread as in 1936. Close seeding and early planting should be encouraged to check the development of the green-fly and therefore the disease.

Bambarra Nuts. The weevil destructive to the ripening nuts in the ground, *Apion* (*Piezotrachelus*) *ugandanum*, Wagn., was found in March at the Makwapala Experimental Station where a certain amount of loss was sustained.

Albizzia. Young trees planted as shade for coffee at Nchenachena were seriously attacked in the developing leaf buds by an undetermined Psyllid or plant-louse. Such damage has not been observed elsewhere.

Eucalyptus. Two interesting observations were made during the year on insects feeding on these trees. In January the Plant Pathologist found an unusually pale-coloured type of tea mosquito bug (*Helopeltis bergrothi*, Reut.,) feeding on the shoots of the trees in a small eucalyptus plantation close to a tea garden in one part of the Mlanje district. The adjacent tea bushes were not being attacked but all stages of the insect were present in the eucalyptus plantation in considerable numbers and were producing the typical gnarled cankers that are associated with the feeding of the normal-coloured mosquito bug on tea bushes. It was anticipated that this pale type of the insect would be found in other eucalyptus plantations but such has not been the case, except for a few isolated specimens obtained in September from another estate in Mlanje, and moreover, inspection of the original plantation some six weeks after the first discovery revealed only a single adult, while at a later investigation in November no insects at all were to be found, though by this time many woody shoots and even entire young trees had been killed by the cankerous formations.

On the other hand normal-coloured mosquito bugs have been found feeding on eucalyptus sucker growth in various districts, though never in the numbers observed in the case of the pale-coloured type in the one place at Mlanje. On this succulent type of growth a wilting effect is produced rather than the formation of cankers.

In captivity it was found that the pale type of mosquito bug would feed readily on tea, but owing to the rapid disappearance of the available material it was not possible to determine whether this type could be maintained through successive generations on this host plant, or whether inter-breeding between the two kinds would take place. As it has been shewn by Mr. W. E. China of the British Museum (Natural History) that there is no difference in the genitalia of the two types it is concluded that they are really the same species and that therefore inter-breeding would be possible.

Nymphs (young forms) of the normal-coloured mosquito bug have been found on a few occasions on eucalyptus sucker growth, and all the evidence thus points to the fact that eucalyptus trees must be regarded as another complete host plant of the tea mosquito bug.

This being so it would be advisable to avoid placing tea nurseries in the vicinity of eucalyptus nurseries or young plantations, or in areas where such trees have recently been felled and sucker growth has developed. The relationship between larger eucalyptus trees, mosquito bug and tea bushes seems, however, to be of little importance.

Eucalyptus Snout-beetle, (*Gonipterus scutellatus*, Gyll.)—It was while searching for tea mosquito bug on eucalyptus trees in Zomba in March that this weevil was first discovered.

It had not been recorded before in the country, but is known to be an insect imported into the Union of South Africa sometime prior to 1916 from Australia. The most northern limit of its distribution recorded in South Africa is at Lydenburg in the Transvaal, but it is apparently absent from Southern Rhodesia and, as far as the writer is aware, it has not been recorded from any part of Portuguese East Africa.

When first introduced into South Africa very serious damage was done for a number of years to certain types of eucalyptus plantations of full growth and it was not until 1928, when a minute wasp parasite of the eggs of the weevil, found in Australia, was specially introduced into the Union, bred up in large numbers and liberated in the plantations, that an effective control of the pest was obtained.

A description of the various stages of the insect, its life-history and the damage it does to eucalyptus foliage has been published elsewhere.

The most important fact is, that not only has the weevil reached this country, but that the egg-parasite (*Anaphoidea nitens*, Gir.) mentioned above is also present, and laboratory observations have shewn that there is a field parasitism of 80 to 90 per cent of the eggs laid.

As both weevil and parasite have been found, up to the present, from Cholo through Mikolongwe, Limbe, Blantyre, Chiradzulu and Zomba districts, both insects must have been in the country for some years. The weevil has not been recorded north of Zomba, at the higher elevations on Zomba mountain though it occurs at about 4000′ on Chiradzulu mountain, or in the Mlanje tea districts where an extensive search has been made. This rather localised distribution may be correlated to some extent with the different species of eucalyptus grown as some are more favoured as food plants than others, but doubtless it will spread further afield in the future.

Although breeding of the weevil appears to be continuous throughout the year, owing mainly to the high proportion of eggs destroyed by the parasite no serious damage to eucalyptus trees has been reported from any part of the country.

The question remains as to how the weevil *and* the egg-parasite reached Nyasaland. It is believed that the weevil arrived in the Union of South Africa from Australia in consignments of apples, and transport of the adult weevils over long distances and liberation of them in new countries through human agency could easily be accomplished, so that the insect itself could have reached this country from South Africa without difficulty. But the parasite had to be specially brought from its original home, it requires eggs of the weevil for its survival, and only some four weeks elapse between one generation and the next. Consequently it would appear that parasitised eggs of the weevil must have been introduced into this country in such a manner that the emerging parasites were able rapidly to find a fresh supply of weevil eggs in which to oviposit.

The successful introduction of the parasite into South Africa was only accomplished by placing parasitised weevil eggs in cold storage. As the present distribution of the weevil here indicates that it must have been in the country some years, it is difficult to see how, in view of the conditions of inter-territorial communications then existing, parasites could have been brought sufficiently quickly into contact with a fresh supply of weevil eggs to enable them to become established. It is stated that the weevil is known only to feed on eucalyptus in South Africa and it is highly improbable that any living eucalyptus trees, which might have carried both healthy and parasitised weevil eggs, have ever been imported into Nyasaland from that country or elsewhere, either in cold storage or otherwise.

Importations of seed, in which egg-capsules might perhaps get mixed, would not be made under cold storage conditions and it seems unlikely that parasites would have been liberated from such postal packets within the requisite time or at the most suitable places so as they could become established in the new enviroment.

It is possible that the introduction into Nyasaland of both host and parasite has occurred through the importation in cold storage of some living plant, such as fruit trees, not yet known as a host plant of the weevil, but it seems to the writer more likely that both insects have spread naturally wherever eucalyptus trees exist and are now distributed over much larger areas of South and Central Africa than has yet been recorded.

Snails. An exceptionally serious and destructive outbreak of snails was reported from part of the Kota-Kota district in November. Maize, pumpkins, beans, and groundnuts were destroyed and it was stated that two villages had been forced to move owing to their depradations. Although an annual occurrence, this year's development appears to have been abnormal. Material was sent to the British Museum for indentification.

Locusts.

The red-winged locust, *Nomadacris septemfasciata*, Serv., continues to be the only species occurring in the country.

Breeding and oviposition by swarms of the 10th generation and the development of hopper bands and adults of the 11th generation was confined to the southern half of the Protectorate. This is the second year in succession in which the country north of latitude 13°S appears to have been completely free from locust development, and only being invaded by very occasional flying swarms of the new generation.

Egg-laying began in December, 1936, and continued through January, 1937, being mainly concentrated in the full length of the Shire river valley, along the Bwanje valley and the south and western lake shore belt as far as the southern half of the Kota-Kota district.

Hoppers started to hatch in the most southern areas on January 4 and hatching continued through February in all the areas. Some late hatching occurred in the higher parts of the Dowa district in March. An unusual feature was the absence of hopper bands in the vicinity of Port Herald, but the sparsely inhabited north-west section of the Chikwawa district was more heavily infested than in previous years. Elsewhere in the Chikwawa district some nine or ten hopper bands were destroyed with sodium arsenite spray. Bands in the Mlanje and Chiradzulu districts were small and scattered and mostly quickly destroyed by natives. Hoppers were numerous in the Upper Shire and southern part of the South Nyasa districts, but strong movement of the bands into food-gardens did not begin until late March by which time some of the maize had been harvested and damage was not as great as was expected. The fungus disease, *Empusa grylli*, appeared among IV and V instar hoppers is this area. On the other hand, in the infested portion of the Kota-Kota district a fair amount of damage was done to crops.

The first flying swarms of the 11th generation appeared on March 10 in the Lower Shire district, development having taken some 66 days, the climatograph of this area for the period showing the temperature and humidity to have been closely approximate to the known optimum range. Adult swarms developed during March through most of the hopper infested district and by April flights were general. The swarms varied greatly in size, and although some were reported to be very large it is doubtful if many of them were as enormous as some of the initial invasion swarms.

The normal movement from the lower to the higher elevations occurred during May, and the north and north-west direction of flight began in this month and continued during June, though circling flights were also prevalent in the Shire Highlands. On about July 19 a swarm entered the Mombera district from the direction of Lundazi on the Northern Rhodesia border and possibly the same swarm was seen at Ekwendeni, north of Mzimba, on July 29. This was the first swarm to be recorded so far north for some years, and in the following months only one swarm in August, one in September and one in October were reported from Katumbi, Loudon Mission, and Miombe respectively, all on the Northern Rhodesia border.

Although circling flights were mainly taking place during July and August a fairly steady north-west movement through Fort Manning occurred during these months.

By September increased movement began to be observed and in October flights in the upper half of the Lower Shire and the Chikwawa districts showed a northerly trend. In this latter month a swarm was found to be ensconced on Nchisi mountain in Kota-Kota district.

During November the breeding colouration appeared in several swarms, nearly all of which were confined to the southern part of the Protectorate. Apart from a reputed very large swarm, seen only from the lake, on the lake shore 20 miles north of Kota-Kota on November 6 and not reported again, the whole country north of latitude 14°S appeared to be quite free of flying swarms. Some indication of a southerly movement was noted among the swarms in the Mlanje and Central Shire areas, but it was not so noticeable that the astonishing, almost complete, disappearance of swarms in December was anticipated. It seemed to be no more than the normal pre-breeding flight to the lower elevations, yet during the whole of December only some half-a-dozen swarms were reported throughout the whole country.

On December 4 a small swarm moved from east to west a few miles south of Port Herald, and about the same time two swarms passed over the Cholo district office in a southerly direction. On December 5 a fairly large swarm was seen at Ncheu which moved west into Portuguese territory the following day, and a single flight was reported to be moving north up the Bwanje valley. From then until the end of the month not a single swarm was reported from anywhere in the Protectorate.

On December 25 a *very thin* swarm arrived from an unknown direction at Nkwale in the Domira Bay section of the Dowa district, and on December 30 a small swarm was found to be egg-laying in Ndamera's section at the most southerly end of the Lower Shire district. Later information indicated that egg-laying may have taken place here at the beginning of the month, possibly by the swarm recorded in the same area on December 4, but it was the only egg-laying swarm reported up to the end of December.

Particular enquiry brought to light no information or evidence of swarms dying from disease or following on oviposition, and as no hopper bands developed during December or in the first half of January, 1938, it seems probable that no eggs *were* laid in November or December.

At the time of writing this report no really satisfactory explanation of this phenomenon can be given. During November and December the prevailing wind in the most southerly districts is from the south-west, and if, as it appears, swarms moved mainly south and west they must have flown almost directly counter to the wind. It is possible that swarms also moved easterly from the Chiromo area, across the Shire river into Portuguese East Africa but no reports of locust movements have been received from that territory since June, and in any case such movement was not sufficiently noticeable to attract the attention of careful observers in that area.

During the year little damage was done to crops by locusts on the whole. In January some food crops were destroyed in the Blantyre district by adults of the 10th generation and in August wheat in the Dedza district was eaten by adults of the 11th generation. Hoppers did some damage to cotton and food-crops in the Chiromo and north-west Chikwawa sections of the Lower River districts, and in the Upper Shire and Kota-Kota districts.

In general the situation was easier than in previous years and the present position, that has arisen so suddenly, augurs extremely well for the coming year. Even if development does not occur in the Protectorate in 1938, however, the advent of flying swarms from neighbouring territories in March or April must be expected.

The work on the climatic factors influencing hopper development, mentioned in the previous annual report, was completed and published in The Bulletin of Entomological Research.

Publications.

Eucalyptus Snout-beetle. The Nyasaland Tea Assoc. Qtly. Jnl. Vol. 2. No. 1. July 1937.
A Note on Tea Mosquito Bug. The Nyasaland Tea Assoc. Qtly. Jnl. Vol. 2. No 1. July 1937.
The Eucalyptus Weevil in Nyasaland. The East African Agr. Jnl. Vol.3 No.3 November 1937.
Notes on the Development of Red Locust Hoppers under Natural Climatic Conditions. Bull. Ent. Res. Vol. 28. Part 3. October 1937.

ACKNOWLEDGMENTS.

Thanks are due to The Imperial Institute of Entomology for the identification of some 57 species of insects.

CORRIGENDA AND ADDENDA TO ANNUAL REPORT, 1936.

Page 22, line 1. *Pseudococcus* = *Ferrisia virgata*, Ckll.

„ „ „ 13. *Miscogasteridae* = *Eulophidae*. *Euplectrus* sp. near *platyhypenae*, How.

„ „ „ 15. *Formicopyia* = *Forcipomyia inornatipennis*, Aust.

„ „ „ 24. Agromyzid fly = *Melanagromyza* ? *soyae*, Zehnt.

„ „ „ 25. Braconid = *Opius* sp.

Chalcid = *Eulophidae*, gen. inc.

Cynipid = Subfamily *Eucoilinae*, *Gronotoma* sp.

COLIN SMEE,
Entomologist.

Report of the Plant Pathologist, Mlanje Experimental Station.

Tea Work.

The field experiments on Ruo Estate completed their third year in May 1937. Up to the present it has been considered inadvisable to publish the results. The three experiments were carried out on "local" jat (China type) tea planted in 1915.

The method of carrying out the experiments was similar to that employed at the Tea Research Institute, Ceylon (Eden, T,. Tea Res. Inst. Bull. No. 6.), the only difference being the employment of buffer rows between each plot in two of the experiments. As in Ceylon the crop records were calculated in terms of dry weight of tea acre per plot for each day's plucking. In this series of experiments weekly pluckings were recorded.

Meteorological Data (1934-1937). The climate conditions in Nyasaland differ from those of the large tea growing countries. This led to the establishment of the Mlanje Experimental Station. It would be advantageous to record the annual meteorological data for this Station since all experiments need to be examined with due regard to seasonal climatic variations.

	Rainfall (Mean) (inches)			Temperature (Mean) (o F)			Relative c/o Humidity (Mean 9 a.m. and 3 p.m.)		
	'34/5	'35/6	'36/7	'34/5	'35/6	'36/7	'34/5	'35/6	'36/7
June ...	6.50	2.49	2.77	65.2	62.8	65.0	81.2	78.5	89.5
July ...	1.14	1.13	4.33	64.2	64.2	63.7	72.5	73.0	88.6
August ...	0.06	2.88	1.34	67.8	63.0	65.2	57.3	68.8	82.9
September ...	2.37	0.02	1.21	68.8	71.8	69.4	64.8	49.2	82.5
October ...	0.24	0.00	5.90	74.8	76.5	77.9	53.3	50,8	60.5
November ...	5.65	13.77	6.43	74.0	76.8	80.1	74.7	73.5	62.6
December ...	16.66	10.24	7.84	74.5	74.2	76.8	82.4	73.1	69.9
January ...	14.53	6.61	16.22	74.8	75.1	77.0	85.9	80.3	76.0
February ...	12.37	14.66	11.78	73.3	76.4	77.7	84.0	86.7	76.8
March ...	9.90	21.30	5.43	73.3	74.8	75.5	83.7	90.2	73.9
April ...	4.70	5.25	4.34	68.6	70.1	73.7	77.9	94.3	71.6
May ...	2.81	2.61	1.18	69.1	68.1	69.4	74.9	85.1	70.7
Total	76.93	80.96	68.77						

Fertilizer Experiment. The experiment was started in 1934. As far as is known fertilizers were not applied until 1929. 200 lb of Nitrophoska per acre was applied in 1929, 200 lb of ammonium sulphate in 1930 and 100 lb of ammonium sulphate in both 1932 and 1933.

Treatment.

1. KrM + P + K
2. P + K
3. KrM + P + K + N
4. P + K + N
5. None (Control)
6. KrM

Applications per acre.

(KrM) Kraal Manure ... 10 tons
(N) Ammonium sulphate ... 100 lb
(K) Sulphate of potash ... 50 lb
(P) Superphosphate (high grade) ... 35 lb

Lay Out.

6 × 6 Latin Square. Planting Distance 4′ × 4′. Individual plots 1/18 acre. One buffer row of tea between plots.

Results.

Mean Yield (Six plots)

Lb. dry wt. of tea per acre.

Treament	1934/5	1935/6	1936/7	Total
1	586	950	1,008	2,563
2	527	702	736	1,965
3	655	1,021	1,116	2,792
4	527	737	726	2,060
5	459	618	647	1,724
6	568	887	931	2,386
Sign. Diff.	78.0	106.4	99.0	
z	0.8678	1.4375	1.6286	1.3955

$P = 0.01$. $n_1 = 5$, $n_2 = 20$. $z = 0.7058$

The Experiment was planned by the Chemist. The Assistant Chemist kindly helped in the statistical analysis of the results and drew the following conclusions.

The outstanding feature of the experiment is the increase in yield produced by kraal manure. In every case where kraal manure was used the yields were significantly greater than when not applied. In cases where all three artificials, nitrogen, potash and phosphate were used, the yield is significantly greater than the control both in the presence and absence of kraal manure. The application of potash and phosphate in the presence or absence of kraal manure is intermediate between nitrogen, potash and phosphate and the absence of all fertilizers, but the yields are not significantly different.

The experiment is to be carried on for another four or five years without the application of any fertilizers. This should give an interesting indication of the relative permanency of the different treatments applied.

Another interesting fact indicated by this experiment is the comparative effect of kraal manure and artificial fertilizers during the season. In Nyasaland, the local jat tea is pruned annually, the cropping season being between September and May inclusive. The bulk of the crop is plucked in the six months between November 1st and April 31st. The following figures are taken from the control plots in the experiment.

1936/7.

% Yield of total crop.

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
4.9	6.1	8.7	19.4	19.3	16.3	13.5	11.8	—

(The crop slowed down so rapidly in May that records were not made during that month).

The following table gives the mean yield of each treatment for two-monthly periods expressed as a percentage of the total yield for each treatment over six months (November-December).

	November and December			January and February			March and April		
Treatment	1935/6	1936/7	Mean	1935/6	1936/7	Mean	1935/6	1936/7	Mean
KrM P K N ...	28.4	29.0	28.7	34.6	39.8	37.2	37.0	31.2	34.1
KrM P K ...	26.9	28.9	27.9	35.0	39.8	37.4	38.1	31.3	34.7
KrM ...	26.7	32.5	29.6	35.8	32.5	34.2	37.5	35.0	36.2
P K N ...	29.8	31.8	30.8	35.8	40.7	38.3	34.4	27.5	30.9
P K ...	29.0	31.1	30.0	37.0	39.6	38.3	34.0	29.3	31.7
Control ...	29.2	31.5	30.3	35.8	40.0	37.9	35.0	28.5	31.7

Significant Difference 1.18.

A comparison of the figures for the March/April period shows that kraal manure has the effect of leveling the yields throughout the season. Nitrogen applied in the form of ammonium sulphate yields heavy crops for the first four months, but the good effect is not sustained as is shown by the distinct fall in crop in the last period. This falling off is slightly greater than with only potash and phosphate or no fertilizer though this is not significant owing to the scant data.

This observation gives a strong indication that artificial fertilizers should be given to tea in Nyasaland in two applications, i.e. half before the rains (or at the time prunings are dug in) and half towards the end of January. This effect was greater in 1936/7 than in 1935/6 probably due to the good rains in the season which is usually hot and dry (August-October).

Dr. Wishart, School of Agriculture, Cambridge, employing the method of analyis of covariance for examining the data showed that "In fact the Latin Square demonstrates the change in effectiveness of the manure, as if the Kraal manure had become increasingly effective as time went on, or at least from the 1st year to the second." Without tabulating the steps by which this conclusion was reached the following "crude" comparison of means shows up the effect strikingly.

Mean Yields. (% of control).

Treatments.	1934/5	1935/6	1936/7	Defference since start.
KrM P K N ...	142.7	165.2	172.5	29.8
KrM P K ...	127.4	153.7	155.7	28.3
KrM ...	123.6	143.5	143.8	20.2
P K N ...	114.8	119.3	123.0	8.2
P K ...	114.8	113.6	113.8	1.0
Control ...	100.0	100.0	100.0	0.0
Significant difference	17.3	17.3	15.3	

Pruning Experiment. The experimental plot was heavy pruned back to 16 inches in June 1933. The treatments were first given in 1934. Pruning was carried out in June of each year. Fertilizers were applied by Ruo Estate uniformly over the plot in November.

Treatments.

1. Annual clean prune.
2. Annual cut-across.
3. Biennual prune: unpruned 1934, clean pruned 1935, etc.
4. Alternate: clean prune 1934, clean cut-across 1935, etc.
5. Annual rim-lung prune.
6. Annual clean prune with secondary hand prune.

Six branches left unpruned on the perimeter of each clean pruned bush. All except two new shoot on the end of branch stripped off by hand shortly before tipping.

Lay out. 6 × 6 Latin Square. Planting distance 4′ × 4′ Individual plots 1/20 acre. One buffer row clean pruned annually between each plot.

RESULTS.

Mean Yields (% of Annual Clean Prune)

Treatment	1934/5	1935/6	1936/7	Total
1	100.0	100.0	100.0	100.0
2	97.2	88.4	81.2	88.7
3	76.0	101.2	76.8	85.9
4	100.4	91.1	97.5	96.0
5	101.9	100.1	99.8	98.6
6	95.3	94.4	100.2	98.4
Significant difference	9.3	7.0	7.0	7.5
z =	1.0839	0.7690	1.4695	0.8048

P = 0.01 , $n_1 = 5$, $n_2 = 20$. z = 0.7058

Although the experiment is by no means complete certain facts are clear. The only two treatments which gave a significant difference in yield in comparison with clean pruning were (a) biennial pruning and (b) cutting across. The latter did not affect the yield in the first year.

Rim-lung pruning gave no beneficial effect and can be considered of no benefit to local jat tea pruned annually.

The secondary hand pruning was carried out to try keeping the bushes relatively free of snags during the first few years of the pruning cycle. In spite of the removal of at least half the new shoots by this means, the yield of the bushes has not been affected. The tendency of the treatment is to cause a slight drop in yield at the start of the season which is compensated by a rise at the end of the season.

Although the cutting across treatment has shown a distinct fall in yeild in the first three years following a heavy prune in 1933, it is intended to modify the experiment for the next six years to include cutting across on bushes which have been clean pruned in the early years of the cycle. The cutting-across may have a different effect to that which it has at the start of the cycle.

Plucking Experiments. The experiment was started in 1934 on a plot of local jat tea which had been uniformly heavy pruned back to 16 inches in 1933. Throughout the experiment the tea was clean pruned annually and fertilizers were applied uniformly over the whole plot. The following systems of plucking were investigated:—

Treatment.

1. Hard plucking, *i.e.* to the janum after tipping.
2. Medium plucking, *i.e.* to one leaf above the janum until January, then plucking to the janum for the remainder of the season.
3. Light plucking, *i.e.* to one leaf above the janum throughout the season.

Lay out. Randomised Block, six replications Planting distance 4′ × 4′. Individual plots 1/21 acre.

RESULTS.

Mean Yield (Six Plots).
Lb. dry wt. of tea per acre.

Treatment	1934/5	1935/6	1936/7
1	748	1,037	993
2	660	925	920
3	553	742	777
Significant difference	67.5	91.5	90.3
z =	1.4519	1.5850	1.3323

P=0.01 , $n_1=2$, $n_2=10$. z=1.0114

The figures show the beneficial effect of plucking old local jat tea hard in Nyasaland. The apparent falling off of this effect in 1936/7 is explained by the fact that the treatments were unavoidably applied a month later than they should have been.

Plucking to the janum facilitates the maintenance of a level plucking surface. With hard plucking this surface may rise about five inches above the tipping surface by the end of the season. It may rise a foot with light plucking.

Mlanje Experimental Station. The tea on the station has sufficiently developed to commence laying out experimental plots. The estimated yield for the 1937/8 season is 500 lb per acre of made tea. The tea was originally planted in January 1934. Owing to bad planting conditions that year the majority of the tea on the Station was planted as supplies in December 1934.

On account of the unsatisfactorily high Standard Errors found in the Ruo Estate experiments, uniformity trials have been commenced for the 1937/8 cropping season.

A pruning experiment, however, has been started without a uniformity trial in order to avoid delay in testing the treatments on young tea.

A pruning experiment carried out on Lujeri Estate will be completed this year. The results will be published in next year's Annual Report and will be of value in connection with the treatment of old Indian jat tea in Nyasaland.

Diseases.

Now that the tea on the Experimental Station has come into bearing the time available for mycological work is strictly limited. The following investigations have been continued.

Armillaria Root Disease. The work on this disease referred to in the Annual Report for 1936 is being continued. Although it is too early to give results it is satisfactory to record that the work is making favourable progress. Culture work in the laboratory has also been carried out in connection with this investigation.

Citrus Mottle. Reference was made to this disease in last year's report. It is pleasing to say that treatment with a zinc sulphate-lime spray (as recommended in U. S. A. and S. Africa) has transformed badly mottled trees to a healthy colour. The application of the spray was given in the proportion of 10 lb. zinc sulphate : 5 lb. of lime : 100 gallons of water. No sticker or spreader was employed.

This result indicates that the disease is due to a deficiency of zinc as in U. S. A. and S. Africa. Use of the treatment should make a great difference to the condition of citrus trees in Nyasaland.

Acknowledgments.

I am greatly indebted to the Manager of Ruo Estates and his field assistants for facilitating the carrying out of the aforementioned experiments. Many thanks are also due to Dr. J. Wishart, School of Agriculture, Cambridge for a detailed analysis of the results of these experiments. His help has been invaluable in elucidating certain statistical problems.

R. Leach,
Plant Pathologist.

Report of the Assistant Chemist.

The year under review has been spent at the Department of Agriculture, Zomba, where I have carried out the work of Chemist, while the Assistant Director and Chemist was acting Director.

It was originally intended that I should proceed to the Northern Province to superintend the Agricultural Survey but, for health reasons, this could not be carried out, and I had to proceed on leave at the beginning of November, in order to have an operation for appendicitis.

Further work has been done on the estimation of traces of copper in tea and, in addition to repeated analyses of tea samples, the whole method has been restandardised with known amounts of copper. These new results, in addition to being extremely consistent among themselves, are in satisfactory agreement with the earlier results obtained with the cruder chemical equipment in Mlanje and, consequently, the accuracy of the method appears to be well established. It has been impossible to bring the work to a conclusion owing to the lack of suitable material. As the result of the success of copper spraying, practically the whole area affected with poor fermentation has been sprayed, and it has been impossible to obtain samples which did not ferment or samples with very low copper contents. Consequently no material was available to prove conclusively the suspected correlation between low copper content and poor fermentation. Thanks are due to the Plant Pathologist, who has arranged with Lujeri Estates to leave certain areas unsprayed this year and it is hoped that, by the middle of next year, the effect of copper will have worn off and that samples of non-fermenting leaf will be available for analysis to complete this work.

Owing to uncertainty about the Agricultural Survey early in the year, considerable time was lost in recommencing work on the chromic acid oxidation of soil organic matter. It was realised that the original method of temperature control was somewhat uncertain and a new thermostatically controlled oil bath was fitted up which, after considerable difficulty in design, eventually was made to work efficiently. The earlier experiments have been repeated with the new apparatus and the results are in reasonable agreement. A definite relation between the amount of chromic acid decomposed, and time and temperature is revealed by graphical representation of the data, though the relation has so far resisted mathematical formulation on the basis of simple assumptions of the type of reaction involved. It is however possible to predict empirically the amount of decomposition which will occur at any temperature from 120-175°C and in any time from 15 minutes to 2 hours, with the result that work can be started on the true oxidation of soil organic matter and the effects of the spontaneous decomposition of chromic acid eliminated.

Considerable interest attaches to preliminary experiments on the ethylene treatment of tobacco. Samples of bright tobacco from Lilongwe district were treated, with air containing 1 part of ethylene in 1000, for 4 days. The treated tobacco, when compared with the untreated, was generally considered to have lost some of its "tang". This result is considered to be of sufficient interest to justify a continuation of the experiments on a larger scale and with more refined methods. With this end in view, the publications regarding the methods used in Germany and Italy have been obtained.

From February till proceeding on leave at the beginning of November, samples of the bulked milk from the Zomba Experimental Station herd were analysed weekly for fat and solids not fat. The average composition of the milk for this period was fat 4.47 per cent. and s.n.f. 9.04 per cent. the highest and lowest figures recorded being 6.9 and 3.2 per cent. and 9.6 and 8.3 per cent. respectively. The accepted minimum requirements for unadulterated milk are fat 3.0 per cent. and s.n.f. 8.5 per cent. hence with a single exception, where s.n.f. were 8.3 per cent. all the samples were satisfactory on this standard. It is noteworthy that, while the content of s.n.f. showed no general tendency to rise or fall throughout the 9 months, the content of fat showed a distinct tendency to rise, on the average, from February to October.

The oil contents of 16 samples of ground nuts were determined. These included probably ten varieties and the produce of three experimental stations.

	% OIL.
1) MAKWAPALA EXPERIMENTAL STATION	
Ntedza wa Limbe (bought from natives)	47.7
Japanese bunch	44.7
Spanish bunch	47.6
Chimbuwila	46.0
Mtundu waung'ono	43.8
Senegal	44.1
(2) ZOMBA EXPERIMENTAL STATION.	
Senegal	44.0
Gambia	44.5
Spanish Bunch	44.8
Virginia Bunch	43.2
Chimbuwila Large	43.1
Chimbuwila small	42.3
(3) DOMIRA BAY.	
Spanish Bunch	45.6
Gambia	45.3
Native	46.7
Barberton	46.7

The averages for, and the maximum difference in oil content were:—

Makwapala Experimental Station	45.67%	3.9%
Zomba Experimental Station	43.47%	2.4%
Domira Bay	46.08%	1.4%
All samples	45.07%	5.3%

The usual routine work of the chemistry department was carried out. Analyses were made of 11 samples of Indore compost and analyses of soils and fertilisers were carried out for advisory work. Throughout the year the Veterinary Department was supplied with standardised decinormal iodine for dip testing; and the testing of stomach contents, from cattle suspected of dip poisoning, was undertaken.

Comparatively little travelling was done during the year but visits were paid to several estates in Mlanje and Cholo and advice given on manurial programmes and soils.

I. ARMSTRONG BLACK,
Assistant Chemist.

Report of the Agricultural Officer, Ncheu.

General.

With the transfer of agricultural headquarters from Dowa to Ncheu the area hitherto under the control of the Agricultural Officer, was extended in the south to embrace the whole of the South Nyasa district, that portion of the Upper Shire lying to the west of the Shire River and the southern portion of the Ncheu district. Immediately prior to this rearrangement these latter areas had been under the charge of the Agricultural Officer, Blantyre.

The new area may be defined as being situated between the Shire River at Liwonde in the south and the Dwambasi River (Kota-Kota/West Nyasa district boundary) in the north. In round figures the area covers some 15,000 sq. miles and carries a native population of 600,000.

Each of the six administrative districts represented has at its disposal the services of an Agricultural Supervisor. The latter work immediately under the Agricultural Officer. Each Supervisor is provided with a staff of native agricultural instructors and it is his function to maintain close contact on all agricultural matters with the Administrative Officers in whose districts he operates. His duties allow that he is in touch with the African agriculturist at all times and even if progress may appear to be slow and that at first set backs would appear to out-number the registerable advances made it is reasonable to acclaim that good work is being attempted and that time alone will show in adequate manner some concrete evidence of the general uplift of native agricultural welfare which it is a proclaimed purpose to achieve.

It is to be noted that in connexion with the native tobacco industry, and to which reference is made on page 35 of this report, there exists an independent native staff of instructors who are employed solely in the furtherance of this very important native grown crop. The latter are provided by, and paid for, by the Native Tobacco Board. Their work is guided by this department and in strictest accordance with the requirements of the Board.

The disposition of agricultural staff within the area covered by this report is tabulated below :—

Area of Influence		European Staff		Native Staff
As above described	1	Agricultural Officer		Nil
S. Nyasa and portion of Upper Shire district	2	,,	Supervisors	(x) 8 N. A. Is
Ncheu and portions Upper Shire and Dedza districts	1	,,	,,	5 Kapitaos (N. T. B.) 8 N. A. Is
Dedza and portion Dowa highlands area ...	1	,,	,,	5 N. A. Is
Dowa and portion Dedza district	1	,,	,,	5 N. A. Is
Kota-Kota and adjacent highlands	1	,,	,,	5 N. A. Is

Native Food Crops.

In the Fort Maguire area of South Nyasa, N. A. Makanjila, the combined factors of adverse seasons, the locust pest, and, due to the heavy and sustained rise in the level of the Lake, a temporary loss of valuable agricultural land situated along the lake-shore have produced in the aggregate a state where a marked shortage of food exists.

The situation has not been helped since not only is the Yao a poor agriculturist but in this particular instance he has been deprived of an essential aid to his livelihood viz. fish. This commodity in the past had provided largely for him a means whereby it was his custom to augment his home grown food crop requirements by an organised system of barter (kutindanya 'Y) of fish for maize and other food-stuffs from adjacent areas. It is believed that the abnormal rise in the lake-level has had some adverse reaction on the feeding grounds of the fish and that the latter have migrated to, and congregated in, other areas where their essential foods now occur in greater abundance *e.g.* Lake Pamalombe.

Meantime an attempt is in hand to raise by propaganda methods the standard of agriculture as practised in the area concerned. With this objective in view an Agricultural Supervisor, working in close collaboration with the District Officer concerned, has been posted temporarily to the area for this special purpose. His aims are to encourage a stricter and more serious attention to crop management generally; to inculcate in the native a need to attempt something for himself and to urge upon him the value of such standby crops as cassava and pigeon pea. There exists a need for a more thorough safe-guarding of cultivations against depradation by marauding fauna and seed-eating birds. A reasonable degree of protection can be readily attained if the community have at heart the will and energy to take the steps necessary in this connexion since the uses of the several native devices, the *sanja* ('Y), *uwigo* ('Y) and *lukonje* ('Y), are not only well known to them but such as when adopted and utilised in a really serious manner afford a surprisingly efficient insurance against severe damage and/or loss to crops.

A cordial degree of administrative support is being afforded to the work in hand and it will be of interest to see what value attends the efforts put forth to remedy the position.

Groundnuts. In pursuance of a year or more old policy to foster this crop from the dual aspects of both cash and food (diet) considerations some forty tons of imported seed stocks of the Spanish Bunch variety were imported for sale to potential native growers in the Dedza and Kota-Kota districts. It had been planned to provide S. B. nuts for the Chimbalanga area of the Dowa district also but it was unfortunate that the orders placed in other territories by the Department were not met in full. It was but natural therefore that when natives sought to purchase at Mkhoma what they had been led to believe would be bunch type nuts and in lieu thereof were offered stocks of a local variety sales were somewhat slow in consequence.

It must be said to the credit of the Dowa natives that in view of their keen disappointment they did well to take as much of these seed stocks as the Mkhoma sales have revealed to-date.

The Kota-Kota district disposed of its total stocks of S. B. nuts, (revealed at 9 tons approx. to date) but a definite dearth of money in circulation in the Dedza district led to a shortfall in the sales of estimated requirements. Nevertheless some 15 short tons were disposed of from seven depots placed at suitably central points.

In all cases seed stocks were sold in shell at the fixed rate of 3 pounds per one penny.

It would appear that at some earlier date considerable stress had been laid upon a need to *import* improved seed stocks of the bunch type since the existing strain in local use was considered to be of low value in terms of yield. This may well have been the case but it is not improbable that low acre populations due to an over wide spacing rate such as is practised habitually by the native grower had much to do with the adverse criticism levelled against yield.

In this connexion it is of interest to remark that varietal trials conducted by this department have demonstrated that the bunch type is an inferior in terms of yield to such local indigenous varieties as *ntedza wonandi*, *chimbuwila* and *miyowa*. Corroboration of this assertion can be obtained by reference to the work "West African Agriculture" by Faulkner & Macie. These two acknowledged authorities on native agriculture state that in the large established ground-nut producing areas of Nigeria experience has given adequate proof of the superior yields which local native sprawling types have in marked advantage over exotic bunch types.

Maize. With the object of stimulating interest in the wider cultivation of this cereal as a cash crop an eight ton lot of selected flat white seed maize was introduced for free distribution to potential growers in the lowlands of the Ncheu district and adjacent areas.

A total of 591 issues are recorded and making due allowance for the need to sow a heavy seed rate to counteract low germination * it is probable that somewhere in the neighbourhood of 300 acres have been established. The equivalent in terms of native production of a potential 200 ton crop for market.

A difficulty with this crop as grown by the native for the sole and ultimate purpose of sale and export is that it must be grown in pure stand. This measure tends to minimise the risk of cross-fertilisation and so preserve in reasonable degree of uniformity the original standard of the grain and in quality as required by the trade. The execution of this requirement should not seem to present a hardship but when it is realized that the native shows a marked preference for his own mixed maize (since it is so much a superior keeper to the softer maize popular on the home

* It was unfortunate that the sample returned a low germination percentage and that a quantity of the seed was so weevil-infested as to render it unfit for issue.

market) it is not a simple matter to influence him to undertake that he will cultivate two separate gardens under the same crop, viz. (*a*) maize from his own stocks for food and (*b*) maize from our stocks for the grain market. His natural tendency is merely to increase the acreage he would normally put down to maize and so accommodate both varieties in a mixed stand in the one garden. Such procedure, for the reasons given, is clearly undesirable.

Economic Crops.

Tobacco. With the forthcoming change in the method of disposal of this crop two receiving stations have been erected in the Ncheu district (*a*) at Mbemvu to meet the requirements of the dark-fired production from the highland areas and (*b*) at Sharpe Vale to cater for the sun-cured crop as produced in the lowlands.

For the forthcoming season it is aimed to produce a crop amounting to a quarter of a million pounds each of sun-cured and dark-fired leaf. A total of 2,089 growers have been registered and these are divided between the dark-fired and sun-cured markets in the totals of 1,169 and 920 respectively.

Cotton.

The change over in this season from controlled to decontrolled markets brought in its train considerable criticism and it was but natural that the bulk of this emanated from the buying agent himself since had he bought in an efficient manner and in strict keeping with his true purpose as a buyer he would have had to examine for himself what in past years had been inspected and passed for him. In short the new system meant not only more work for the buyer but in addition to buying having become a skilled and tedious task it chafed the more so by it saddling him with the responsibility for the grade of cotton which he accepted. In these latter reversed set of circumstances it is but small wonder that there has come a strong outcry for a return to controlled markets.

It had been feared and even stated by some that decontrol would result in disorganisation and confusion at markets. These fears proved extremely groundless as markets were well conducted and orderly throughout.

What has been a direct result however is a noticeable falling-off in the standard of grading. This would not appear to have been strictly the case if the grade percentage figures as taken from buying returns (Table 3) were a true interpretation of the position under this head. But in the circumstances under review these figures do serve to indicate how slack has been the method of buying. It would be unreasonable to suppose that the grower did not take full advantage of the "blind buying" which was a bold feature of all markets. He did so and got away with it to such an extent that the so called grade 1. raw cotton purchased was of an unattractively low standard. This position however must be attributed solely to the buyer upon whom should rest the sole responsibility for what he accepts. Had buyers played their part, and it is but reasonable to expect of them to do so, there would have been little or no lowering of the grade standard now complained of.

Competition was healthy throughout and whilst this is always to the good its benefits were greatly off-set by that pernicious system which allows of multiple buyers under one flag. This latter *modus operandi* forces an agent whose commission is at stake to buy blind since if he attempted rigorous inspection custom would go of certainty to a less exacting a purchaser.

From the foregoing it would seem that some form of tightening up is required since (*a*) the maintenance of quality is an essential to the well-being of the industry and (*b*) it is no less an essential to ensure that the producer should receive the full economic price for each grade when offered as a fair sample of strict grading or classification. The passing of cotton in three classes of colour as is customary in Nyasaland does not involve a technical grading and therefore it is not suggested that it is the business of Government to look after buyers interests to an extent that it inspects and passes all raw cotton and assumes full responsibility for the quality as purchased by each and every buyer. Controlled markets are expensive and wasteful of personnel which might be more fittingly employed elsewhere and even when Government did provide markets of this type and carried out the duties of the buyer under the heads of inspection and classification complaints were not infrequent and some cotton was purchased as No. 1 grade when it was in fact No. 2.

A solution appears to lie in the direction of zoning to ginnery areas and a price control by Government within zones in order to afford adequate protection to the producer.

The Crop:—Market returns were down approximately 33⅓ per cent on first estimates and about 15 per cent on the final estimate.

It will be seen that the Dedza area was badly hit. This is made abundantly clear by (a) the yield factor and (b) the average cash return per grower.

Average ruling prices were appreciably down on those which applied in 1936 and it can be expected therefore that in those areas least favoured in acre yield returns e.g. Kota-Kota district there will be a noticeable decline in acreage in the season 1937-38.

Uprooting:—Table *5 gives information under this head and whilst the number of defaulters would appear to be creditably low a swifter compliance with the rule so as to conform more accurately with the date for uprooting is to be desired. Every opportunity is taken to impress upon the grower that early and efficient uprooting and destruction of bushes is a matter of paramount importance in respect of insect control and as such should be a first consideration to himself if he aims to obtain optimum results from his efforts as a cultivator of cotton.

The Season 1937-38:—Active stimulation towards a really marked advance in greater unity of early planting has been vigorously applied in all areas and there are signs that a satisfactory degree of response to this essential to good planting practice has been attained.

Rice.

It has been fittingly recorded elsewhere how satisfactorily this crop has progressed in the Kota-Kota district. This has been achieved as a direct result of the keen enthusiasm displayed by the District Commissioner, Mr. Kenyon-Slaney. By his efforts not only has he accomplished much towards an improvement in the crop itself but by his energy has he secured for it a satisfactory local market. With the recent posting of an Agricultural Supervisor to this area further progress is looked forward to with confidence.

The 1937 crop totalled 134.5 long tons of which approximately 6 per cent (292 bags of *faya*) was sold as graded rice. As previously mentioned the District Commissioner made the marketing arrangements for the crop which, covering expenses so entailed, sold at £815 or at £776 in value to the growers.

Extension Work.

The combined efforts of the District Administration and the departments of Medicine, Forestry and Agriculture are to be co-ordinated in an attempt to raise the general standard of native life in an already selected well-settlement area of the Bwanje Valley.

Bwanje Valley Rural Development Scheme. This department has moved in the matter by the establishment of a demonstration plot. The latter is situated on the western side of the *service road* and in near proximity to Well No. 42. The guiding principle applied to the selection of the site was (a) whilst the soil type should be characterised as representative of the area as a whole it should err on the side of low agricultural value rather than be of a class above average fertility and (b) that it should be adjacent, and as nearly central, to a well group as were possible. These requirements have been fulfilled and the plot has been planted up on a definite cropping scheme such as is designed to carry crops suited to the area and to the native cultivator. It offers and demonstrates a simple system of crop rotation and good agricultural practice such as is calculated may be adopted on a permanent agricultural basis.

To date the department has financed this undertaking but so soon as the Medical Department, in co-operation with the District Administration, have considered the question of better housing and sanitation, in the area to come under influence it is suggested that the necessary money be provided from the Native Authorities Central Fund. Were this proposal to receive support then it is recommended that these funds provide for the upkeep of a suitable Native Agricultural Instructor to supervise work on the plot and to extend its influence into the neighbouring well areas. In these latter circumstances the instructor would reside at the plot and a model house etc., suited to native requirements should be built for him. Such a house would require to be of simple construction and built of local material. Its design should offer no obstacle in the way of its being readily copied by those whom it is hoped will benefit by the influence which the scheme aims to implement. The work of the Native Agricultural Instructor would be directed by the Agricultural Officer.

*Not published.

Soil Conservation.

It is considered that the first step to take in this direction is to aim at a general suppression of *matutu* cultivation in hill-slope areas and to encourage in its stead line planting of crops in modified ridges running approximately with the contours and spaced at three foot intervals apart. This technique has the great value of simplicity and once it has become general not only will a step forward have been made in an effort to stem erosion but a suitable basis will have been created upon which it will be more readily possible to extend the more skilled work of contour bunding and storm drainage. Propaganda directed along these lines was commenced prior to the present planting season and it is gratifying to be able to report that the success already met with augers well for future improvement in soil management.

The Kasakula area provides a good example of a definite advance made and of what can be achieved through the co-operation and influence of the District Administration.

A small soil conservation demonstration has been commenced at Nsipe and from this focal point of influence it is hoped to extend further afield work covered under this head.

Locusts.

With the exception of flying swarms observed near to Ncheu and at Golomoti on December 5th, and at Nkwale (E. C. G. C. Station) on December 25th, no further reports have been made as to the presence of this pest in the areas covered within this report.

No mating or egg-laying has been observed to take place.

Frank Barker,
Agricultural Officer.

Report of the Agricultural Officer, Blantyre.

General. From January to the end of July the writer was in charge of Blantyre, Central Shire, Cholo, Mlanje, Chiradzulu, Zomba, Upper Shire, South Nyasa and part of Ncheu district. From June to the end of the year the Lower River was in his charge and from August to the end of the year the Masambanjati coffee plots also. On the return of Mr. F. Barker from leave at the end of July the north end of the district was handed over leaving the Lower River, Blantyre, Central Shire and Cholo, including the two experimental stations at Masambanjati and Port Herald.

During the year the writer has worked with several of the agricultural supervisors—Messrs. G. C. Dow, G. D. Hayes, W. L. Maxwell, J. W. Pryor, A. D. Souter, and E. E. Carrall-Wilcocks and would like to place on record his very sincere appreciation of their hard and conscientious work. The writer's thanks are also due to District Commissioners, to members of the Empire Cotton Growing Corporation and to principals and agents of the various cotton buying firms for their co-operation and courteous and ready assistance.

The parts of the report on the Lower River dealing with the period of January to June are written from notes supplied by Mr. G. C. Charles to whom acknowledgment and thanks are made.

Meteorological. From the tables* at the end of the report it will be seen that the rainfall distribution over the season varied considerably from "normal". In the south, around Port Herald, a drought period of three weeks in January was followed by an exceptionally wet February and by a second drought of nearly six weeks during March and April. Further north the rainfall was more evenly distributed and in the Chikwawa district the drought periods were shorter and less severe.

Mid season rainfall in the south was insufficient to have any marked effect on crops but further north at Chiromo and especially at Chikwawa good rains in August made a considerable difference to the cotton crops.

The Shire river rose in February and March and large areas of low-lying fertile *dimba* ands were inundated. The river level remained high throughout the season and replanting was impossible on a very large proportion of the *dimba* which usually carries heavy crops of late maize, sweet potatoes and cotton.

The Blantyre and Central Shire districts were more fortunate and weather conditions were good everywhere.

1. Native Food Crops.

General. In the Cholo, Blantyre, Central Shire, Mlanje, Chiradzulu, Zomba, South Nyasa, Upper Shire and South Ncheu districts grain yields were good, in most parts excellent. In a few small areas the crop was only fair but only in the worst of these was a slight shortage experienced towards the end of the year.

Pulses and groundnuts gave fair yields.

One or two exceptions to the above remarks must be made. Along the east side of Lake Nyasa, particularly in Makanjila's section, floods ruined the early maize crop and the continued high water level prevented replanting. Dry weather in February and March prevented normal crop growth and development in non-flooded areas. Grain crops, pulses and economic crops all suffered alike and even by the end of March the position was reported to be serious. The other area in the writer's district which was badly affected by floods and poor weather conditions was the Lower River. In the south, particularly in the riverside districts from Munga cotton market southwards, heavy floods and a poorly distributed rainfall did tremendous harm to all crops. As in the case of the lake shore areas long continued high water levels prevented replanting.

*Not published. Reference may be made to the tables on p. 5.

An area round Ndirande and Soche mountains in the Blantyre district, another round the three villages of Chona, Macheleza and Phalula on the head waters of the Lisungwe river in South Ncheu and a third in the Upper Shire district, known as the Ulongwe area, all suffered a certain amount of food shortage. In all cases the areas were small and natives in them were able to obtain food cheaply and easily from more fortunate neighbours.

Maize. The main crop, harvested early in May was good over the greater parts of the central area and in parts of Mlanje, Chiradzulu and Blantyre there was a surplus. Complete failure of the crop occurred in two areas due to flooding. All over the Lower River with the exception of the small area of Muona-Masengere on the Chikwawa-Lower Shire boundary the crop suffered from badly distributed rains and yields were low in consequence. Insect pests and fungous diseases were noticeably absent.

The Blantyre and Limbe native populations depend for their food supplies, chiefly maize, upon the gardens in the Chiradzulu and Blantyre districts. This year maize was fairly cheap and plentiful in Limbe but dearer and scarcer towards the end of the year in Blantyre. The poorer yields in the Ndirande-Soche area were partly responsible for this.

On the Lower River natives were buying maize in Cholo and Blantyre by September. The District Commissioner, Lower Shire, imported maize when the shortage became acute and succeeded in keeping down the price in the native market to a reasonable figure. In the Chikwawa district the crop did not suffer quite so badly; there was a shortage in the sections of Kasisi and Daniel through poor rains and a less serious shortage in Beleu's section through locust hopper attack.

Up-country, particularly in the Blantyre and Zomba districts, witchweed (*striga spp.*) was widely distributed. Natives were encouraged to hand-pull this parasite before it flowered and more attention was paid to this advice than formerly.

Machewere. (*Pennisetum typhoideum*). Very little of this crop is grown anywhere but on the Lower River and in certain parts of Mlanje and Cholo and in all parts yields this season were high. Harvest was not so early as usual and took place in March on the Lower River and April in other districts. The dry March, particularly in the south of the Lower River, favoured the crops and yields were excellent. A smut (*Tolyposporium penicillariae*) and a green ear mildew (*Sclerospora graminicola*) were reported on a few occasions; they did no appreciable damage to the crop.

Mapira. (*Sorghum vulgare*). This crop was at one time very popular on the Lower River and the acreage under it was as large as, if not larger than, the acreage under maize. In certain areas, between Chiromo and Port Herald and south of Port Herald along the foothills, it was especially popular and planted with *machewere* usually gave a high yield. During the bad locust years natives lost most of their sorghum crops to the hoppers, the plants being in the most vulnerable stage just as the hopper bands formed, and seed stocks since have been very low. An issue of improved seed is planned for the 1938-39 season. The crop has never been as popular in the Chikwawa district as further south. In other districts one variety, *Namudzi* (*S. conspicuum var. validum*) is widespread but is only found in small patches. It is generally ratooned and the heads are ready for harvest early in March. Some fairly large gardens of mixed seed on the Lower slopes of the Cholo hills, in the Mlanje and Chiradzulu districts and in parts of Blantyre gave high yields. On the Lower River the favourite mixture with *mapira* is *machewere* but in other districts maize generally takes its place.

A certain amount of stem borer (Chilo sp.) was seen in the crop but both this and sorghum smut (*Sphacelotheca sorghi*) were of comparatively little importance.

An experiment carried out on the Port Herald Experimental Station with a variety of mapira called *Ngonkho* (*S. Roxburghii var. hirsutum*) showed that applications of compost appear to lower the yield. The differences had no statistical significance however and may have been due to chance.

Maere. (*Eleusine coracana*). All over the writer's area this short-term crop gave poor yields. This was due in part to bad weather conditions generally and also to a very bad infestation of a Mylabrid beetle (*M. dicincta*) which ate the flowers and a small Tenebrionid beetle (*Ootheca mutabilis*) which ate the leaves. In the South Nyasa and Upper Shire districts the crops were an almost complete failure and further south although yields were better there was no surplus.

Oilseeds. Rosette disease has been very little in evidence on the groundnut crop this season. It will be remembered that two seasons ago the crop all over the country was very badly attacked and that seed stocks were reduced to a dangerously low level. It has been definitely established in Tanganyika that close spacing and early planting exert an effective control on this *aphis*-carried virus disease and propaganda to this effect amongst natives appears to be producing a certain amount of control here too. The groundnut crop in Kawinga's area Upper Shire district is capable of considerable development.

It is doubtful whether groundnuts will ever be an attractive economic crop to the native until purchasers are willing to buy the crop in the shell and remove the shells by machinery. Although seed stocks are now back to their normal state the acreage under the crop this past season was small and there was no surplus for export. The small local groundnut trade is almost entirely in the hands of Indian traders. There are some large areas of land on the Lower River and in Native Authority Kawinga's area in Upper Shire which are very suitable for groundnut growing but with the present lack of suitable marketing conditions it would be very unwise to encourage an increase in native cultivation except for food purposes; groundnuts would form a very welcome addition to the native dietary and should be used much more than they are.

2. Economic Crops.

Cotton. Seed distribution commenced early in November in the Central Areas and on January 11th on the Lower River.

Amounts by districts are given below:—

	Seed distributed.
South Nyasa	41½ tons
Upper Shire	40 ,,
Ncheu (South)	8 ,,
Mlanje	23 ,,
Blantyre	20 ,,
Central Shire	76 ,,
Chikwawa	390 ,,
Lower Shire	750 ,,

Food shortage towards the end of 1936 and early in 1937 resulted in delayed cotton planting in many areas; by the end of March it was obvious that in all the central districts cotton planted in late January and February would give no crop. On the Lower River cotton planted in February failed to make sufficient growth to carry it through the dry March and in light land areas yields were disappointingly low. Natives who took seed directly the stores opened and planted during January obtained the best results; insect attack and a poor season affected all cotton.

Seed on the Lower River was issued from 15 stores, a number which will be increased slightly next year. The garden census revealed a decrease of 14.1 per cent. in the number of gardens from 1936, the result to a large extent of the heavy river floods, the biggest fall in numbers occurring in the districts lying along the Shire banks. The size of the average garden was 1.7 acres approximately and it was estimated that 56,700 acres of land were under cotton—a decrease from 1936 of 4.7 per cent.

In the Blantyre and Central Shire districts in comparison with 1936, there was an increase of 133 gardens (21 per cent.) in the former district and a decrease of 272 gardens (14.4 per cent.) in the latter. The size of the average garden was 1.6 acres in the Blantyre district with approximately 1,218 acres under cotton and 2.3 acres in the Central Shire district with 3,721 acres.

Numbers of gardens in other districts are given below:—

District	No. of gardens	Decrease from 1936	
South Nyasa ...	2,912 ...	939	(24%)
Upper Shire ...	1,957 ...	184	(8.5%)
Mlanje	1,827 ...	2,228	(55%)
Ncheu (south) ...	310 ...	55	(15%)

The total crop on the Lower River was 3,000 tons, a decrease of 1,624 tons from 1936. In the Blantyre district the crop of 110 tons showed an increase of 35 tons over 1936 and the Central Shire crop of 415 tons was 82 tons more than that of 1936. A table of cotton production in tons of seed cotton during the past few years is given below :—

District	1937	1936	1935	1934	1933	1932
Lower River	3,000	4,624	6,485	2,870	2,012.5	2,656
Blantyre and Central Shire	525	408	593	163	159.5	42

The disappointing crop on the Lower River has been attributed to various causes. The Department's policy of obtaining a close season by not opening seed stores until January 11th has occasioned a great deal of criticism but it is certain that the poor crop cannot be attributed to late issue of seed. Out of a total of 33,375 gardens 22,421 were planted in February, March or even later—at least three weeks or more after the stores were opened. Seed distribution is not the slow process that it has been painted and at any seed store 1,000 natives can obtain seed easily in one day; in three days every native on the Lower River could have obtained seed last year and all light land gardens could have been planted within a week of the stores opening. Pandering to native laziness by opening stores earlier is a foolish line of attack and will lead nowhere.

The main causes of the poor crop on the Lower River were insect attack, an excessively dry March (the lowest in the Port Herald area for at least ten years) and heavy river floods. Red bollworm attack developed early in the season and took an even heavier toll than usual. Even the late crop on the Ndindi Marsh suffered badly. The dry March caught the late planted light land crop—in the Mbuzi, Nkadana and Tengani areas gardens planted in mid February or later grew a little and then died before flowering—and yields were very low indeed. With good March rains many of the gardens would have given a small crop at least. The heavy Shire floods washed away many of the early planted dimba gardens and as the water level kept high throughout the season many gardens were under water the whole year and were never planted. There was a fall in the number of dimba gardens from last year of 57 per cent.

The state of the cotton markets this season was chaotic. Natives quickly found that if one buyer refused to buy ungraded cotton another was not so particular and the standard of good seed cotton gradually fell. The crop was bought in three grades and the first grade did not deteriorate so rapidly as the others. The second and third grades very soon became more and more mixed until by the end of the season there were to all intents and purposes two grades only—a poor first and the rest. At the opening markets prices were 1½d., ¾d. and ½d. for the three grades at the ginneries, slightly less at outside markets. These prices fell rapidly to ⅞d., ¼d. and ⅛d. for the three grades.

Special attention was paid to uprooting this season and by the uprooting date, October 30th, practically all gardens on the Lower River had been uprooted and burned. With a date set a month earlier than the preceding seasons there were only 12 defaulters in the Lower Shire as against 191 the year before and five in the Chikwawa district as against 977 in 1936. The entire credit for these excellent results must be given to the two Lower River agricultural supervisors Messrs. E. E. Carrall-Wilcocks and G. D. Hayes, and the two District Commissioners Messrs. K. W. Switzer and H. S. Selous. In the Blantyre and Central Shire districts there were 131 defaulters on September 30th, 92 of whom were in Native Authority Symon's area on the Lisungwe. With the exception of this area (where some cotton was not uprooted until the middle of November, six weeks after the date, and a great deal of the work was done in slovenly fashion) the districts were quite clean and free of bushes within a week of the date.

A great deal has been said during the year about early and late planting of cotton on the Lower River. A great deal of emphasis has been laid, quite unnecessarily and quite wrongly, on this time of planting. Early planting alone will not solve the problem of producing a good crop every year on the Lower River; in some years it is as dangerous a practice as late planting. Early planting does not necessarily follow early seed issues.

A close season of *at least* two months; good preliminary cultivation (practically unknown at present except on some of the very heavy land); pure stands on light land and reasonable inter-planting on heavy; clean weeding; early thinning—all these together will lead to good yields every year on the Lower River and planting can take place any time in January and up to the middle of February with safety on even the lightest land. As far as growth and development of the plant go earlier planting still, with topping, might give even better results but with red boll-worm the close season is essential and planting earlier than January is impracticable at present.

Wheat. A small native crop of wheat is produced annually on the Neno hills in the Central Shire district and is sold in Blantyre. This year plants were badly attacked by stem rust (*Puccinia graminis*) and yields were much reduced. Plans have been made to conduct some observation trials at Native Authority Dambe's vallage and a small garden has been prepared and terraced ready for planting early in 1938.

3. Experimental.

Port Herald. On the Port Herald mphala station the experimantal work suffered from the change of staff and for two or three months had to be left in sole charge of a native capitao. It was impossible to make any useful observations and the statistical results obtained were of little value.

The compost trial with sorghum has already been mentioned.

The cotton time-of-planting trials gave no significant results although the plots planted in February gave slightly heavier yields than those planted in January. Results from these trials are in any case of doubtful value. When the limiting factor to cotton production is insect attack it is obvious that the earliest plants merely breed up insects which attack successive plantings alongside in greater and greater numbers.

A strain test was carried out with five strains from the Empire Cotton Growing Corporation's Station at Domira Bay, the control being the ordinary bulk strain from the Port Herald ginnery as issued to natives. None of the strains proved to be any better than the control.

Groundnuts gave poor yields on the station owing to drought conditions and the combined time-of-planting and spacing trial was a failure as the late plantings failed to mature. The experiment did show that early planting is essential to obtain a crop at all and it was noticeable that the incidence of Rosette disease was considerably less in the close spacing.

Machewere (*Pennisetum typhoideum*) yielded well when planted early, giving an average of 750 lbs of grain to the acre over the whole station. *Mapira* (*Sorghum vulgare*) suffered from the late drought in March and April and the Indian variety averaged only 209 lbs per acre; the variety *Ngonkho* did better and gave 661 lbs per acre.

A cassava, named *Virigodo* or *Biti Sumani* in the vernacular, was brought in from the Cholo Hills by the Chiromo Agricultural Supervisor Mr. E. E. Carrall-Wilcocks, and planted on the station; it has partial immunity to mosaic disease. For the first year it showed almost complete immunity but this is just beginning to break down in the second year as it did at Makwapala and Domira Bay.

Seed stocks of various small millets were retained but none of them are popular with natives.

Pulses suffered from the poor rainfall and yields were low.

Early and persistent floods destroyed the experimental plots on the dimba station and even the rice was killed. After the levels had dropped some maize was planted and gave a fair crop which was used for feeding labour.

Makwapala. As with Port Herald station so with Makwapala—district work over a large area and change of staff prevented any useful statistical work from being done.

A combined spacing and time-of-planting experiment failed from the mixing of seed on the late-planted plots while the writer was away. Observations made pointed to healthier plants and heavier crops in the early planted and close-spaced plants but no statistical significance was obtained.

Sorghums were ratooned for the second year in succession; three varieties only survived and even amongst these there were many gaps.

A small interplanting trial of maize and sorghums with six replications of three teatments—maize alone, sorghum alone and maize and sorghum mixed—gave no significant results beyond that of showing that the Makwapala soil cannot carry an economic crop of maize.

A time-of-planting trial with *Vigna catjang* gave no significant results as the early plantings were wiped out by a bad attack of a small leaf-eating beetle, *Ootheca mutabilis*, which appeared early in January on the November plantings. The attack lasted until well into February and only the late January and February plantings gave a crop at all. Even these later plantings were attacked by two flower eating Mylabridae, *Mylabris dicincta* and *Ceroctis trifurca.*

A useful short-term cassava, vernacular *Mpwapwa*, collected by the Upper Shire Agricultural Supervisor, Mr. W. L. Maxwell, was introduced to the station and gave a yield of just under 7 tons per acre. Six other cassava, with the vernacular names of *Namanya*, *Namatamba*, *Biti Sumani*, *Magaligao*, *Chitekere* and *Ngwalangwa*, were grown in small observation plots and in small bulks. The small plots were harvested and notes kept of weights of roots and size and colour. Native information was also collected on the various types. Unfortunately the small bulks were harvested after the writer left and the weights were not kept.

Cotton seed from the 1935 crop (i.e. two years old) was planted in a small observation plot with seed from the 1936 crop alongside. Both plots suffered heavily from insect attack but germination was as good with the old seed as with the new and there appeared to be no difference in growth and development between the two plots.

Pigeon pea suffered from the leaf and flower eaters mentioned in connection with the *Vigna* plots. The attack of *Mylabris dicincta* was particularly severe.

Grafted citrus trees obtained from South Africa were planted out on the Station on terraced land and will be grown under irrigation.

Small observation plots of sugar cane and rice were planted on some low-lying land along the Matawale stream.

Progeny rows of castor oil were planted and notes kept of growth and development. Before planting seed obtained in the district was sorted out according to size and colour. It was found that there was a very high percentage of cross fertilisation and that ripening was extremely uneven. It is obvious that harvesting on a large scale would be an extremely expensive and long drawn-out operation.

Masambanjati Coffee Plots. During 1937 the *arabica* coffee bushes in the native coffee gardens came into bearing and in August the crop was sold to Mr. I. Conforzi at a price of 2½d per lb. for first grade and 1½d per lb. for second. Fifty four gardens produced three tons of coffee beans and the prices received by growers were as follows:—

Crops from	2	gardens	sold	for	over		£5		
,,	,,	1	,,	,,	,,	between	£4	and	£5
,,	,,	5	,,	,,	,,	,,	£3	and	£4
,,	,,	5	,,	,,	,,	,,	£2	and	£3
,,	,,	7	,,	,,	,,	,,	£1	and	£2
		13	,,	,,	,,	,,	10/-	,,	£1
		21	,,	,,	,,	under			10/-

The four small observation plots on the station came into bearing this year. Details of these plots are given below:—

A. Coffee under natural shade trees from the bush. Cover crops of *Calopogonium mucunoides* and *Dolichos Hosei*. 244 bushes yielding 73 lbs. of beans.

B. Coffee under *Aleurites montana* with soya beans variety (*O-too-tan*) as cover crop. 227 bushes yielding 80 lbs. of beans.

C. Coffee under *Aleurites Fordii* with buckwheat followed by soya beans (*O-too-tan*) as cover crops. *Leucaena glauca* on terraces. 240 bushes yielding 98 of beans.

D. Coffee under *Gliricidia maculata* with *Calopogonium mucunoides* and *Dolichos Hosei* as cover crops. *Leucaena glauca* on terraces. 245 bushes yielding 62 lbs. of beans.

Two acres of Tung Oil—one of *A. Fordii* and one of *A. Montana*—have been established on the station but in neither case are the plants happy and growth is poor. Next year this land will be under-cropped with groundnuts.

Fifteen varieties of shade trees are to be given a trial on the station next season and *Calopogonium*, *Dolichos*, Buckwheat, Soya beans (black and yellow varieties) *Lima*, *Rangoon*, *Tepary* and *Vigna* beans are all to be grown in bulk for seed supplies.

Fifteen thousand Natal Queen pineapple suckers imported into Nyasaland during November were planted out on the station and are now established.

A pamphlet on the coffee stem borer was prepared by the Entomologist and copies were distributed to each Native coffee grower.

All native coffee gardens were visited at least twice during the season.

4. Demonstration Plots.

The two plots started by Mr. F. Barker in 1936 at Muona and Mafumbe have already had a definite influence for good on native agriculture in their vicinities. The results obtained last year were sufficiently striking to attract the attention of nearby native cultivators and many visits were paid by them to make enquiries of the capitao-in-charge.

The Muona plot has been handed over to the Empire Cotton Growing Corporation for the 1937-38 season but the cropping programme is to remain unaltered. Two more demonstration plots have been opened at Nkadana and Tengani. The future of the plots is at present uncertain but as funds are not available for the upkeep of more than two or three plots per annum it is proposed to pass on the plots, when they have been run for a season or two, to the nearest Native Authority to be continued by him on certain definite lines laid down by the Agricultural Officer of the district. An alternative plan is to turn over each plot, after it has been run for at least two seasons, to an intelligent local cultivator to run as a small-holding; in this case the new owner would run the holding in exactly the same way as it had been run previously but all the produce in the way of food and economic crops would be his to dispose of as he wished.

The pure stand cotton yields were sufficiently out-standing to attract native attention and the average yields of 590 lbs. per acre on the Mafumbe plot, planted between January 14th and January 23rd and of 890 lbs. per acre on the Muona plot, planted on February 11th, compared noticeably with cotton in surrounding native gardens. The heaviest yield on the Mafumbe plot was 820 lbs. per acre of pure stand cotton and on the Muona plot 948 lbs. Propaganda amongst natives drew their attention to the benefits deriving from good pre-cultivation, subsequent weeding, hoeing and thinning rather than to the comparatively unimportant point of the dates of planting.

Cotton interplanted with maize gave poorer results than pure stand cotton and interplanted with *machewere* gave the lowest yields of all. On the Mafumbe plot cotton planted with maize dropped its yield from 590 lbs. per acre to 412 lbs. and with *machewere* to 204 lbs. On the Muona plots the yield with maize dropped from 890 lbs. to 644 lbs. and with *machewere* to 324 lbs. By comparison with pure stand the yields of maize and *machewere* interplanted with cotton were little affected.

Pulses gave poor yields on both plots.

A demonstration plot has been opened in the Blantyre district on the main Blantyre-Matope road 15 miles from Blantyre close to Pelusi Village. It will be used primarily for work on native food crops.

5. Native Agriculture in General.

Lower River Food Shortage. The December-February food shortage on the Lower River occurs as regularly as ever—in good harvest years as well as bad, in dry years and wet years and flood years. In some years the hunger period commences earlier and lasts longer and in some it is alleviated by late dimba crops of maize and sweet potatoes; it is terminated by the *machewere* harvest in February. In good food crop years it is due to sheer improvidence; congested though the population of the Lower River undoubtedly is there is still just enough land available to support it, although the time is rapidly approaching when this will not be so. Food conservation in some form or another is essential and the system of communal village grain stores described by the writer in the Department's Annual Report for 1931, page 23, will be re-established on the Lower River in 1938.

The District Commissioner, Port Herald, has informed the writer that one Native Authority, Mlolo, has already voluntarily suggested a form of control of beer making in his district and there is hope that this will spread to other Native Authorities. If effective control can be established, and there is no reason why it should not be, another cause of the annual food shortage will have been removed.

The harmful effects of the Lower River food shortage are reflected in the production of all food and economic crops during the ensuing year and the harm done therefore tends to be cumulative. During the hunger months natives spend their cotton money on food brought into the markets by Indians and natives from Cholo and Blantyre and sold at exorbitant rates. The District Commissioner this year kept the price within reasonable bounds by importing maize himself but this is obviously only a palliative measure and does not strike at the root of the matter.

So long as these yearly shortages continue the native cultivator cannot be expected to produce good crops as he is hungriest just when some of the most important agricultural work on the crops has to be done; preparation of gardens, planting and cleaning all have to be done between November and February.

Seed Selection. Seed selection work has been continued but a more intensive campaign has to be conducted before any noticeable improvement in crops is obtained. The *machewere* crop on the Lower River will obviously benefit from large scale intensive seed selection; heads are small and poor and work on the demonstration plots and Experimental Station has shown what excellent results can be obtained by simple mass selection in the field.

6. Soil Erosion.

Work on contour ridging native gardens was continued in the Mlanje and Chiradzulu districts and commenced in a new area around Soche Mountain in the Blantyre district. The work is slow and constant supervision is necessary to see that the ridges are made properly and kept up once made. A certain amount of trouble has been experienced through gulleys forming at the edges of gardens, particularly where ridges are long and are taken through three or four gardens before discharging. As a rule small side drains can be kept in control quite easily by planting the sides and bed with *nsenjere* grass (*Pennisetum purpureum*) and any gulleying is prevented. There is always a certain amount of trouble experienced in persuading natives that these drains are quite as important as the ridges and that the work of planting them up should be divided amongst the owners whose gardens are protected by the ridges.

7. Advisory.

A few visits were paid to European planters at their request but the writer had no time to make any more than those definitely asked for. One or two of the Missions were visited during the year and some promising work at the Universities Mission, Likwenu, had to be abandoned when the writer left Makwapala. The Mission garden at Domasi was contour ridged for demonstration purposes.

A short course of lectures on crops and insect and fungous pests was given at the Jeanes Training Institute, Domasi.

A few natives have approached the writer for assistance and advice and where possible this has been given.

A preliminary visit to the garden and a chat to the owner on the spot has usually ensured his agreement to suggestions made.

E. Lawrence,
Agricultural Officer.

Report of the Agricultural Officer, Dowa, January—August, 1937.

The Weather. In the southern half of the district the first rain fell late in November, to be followed by a general fall of little over half an inch early in December. Thereafter no rain fell for a fortnight and the ground did not receive its first real soaking until Christmas. It cannot, therefore, be said that the planting rains were very favourable; and both January and February were so wet as to hinder cultivation and weeding on all the heavier soils throughout the district; and in some of the higher elevations the maize was materially effected by the lack of sunshine. The rain was more steady than usual and severe storms were infrequent; but nevertheless by the end of January approximately half of the normal annual rainfall had been recorded at all stations in the district. In contrast to last year, March was very hot and dry, and no more than one or two inches fell at any point in the cotton area. Flowering suffered to some extent, but the crop was revived by a good general fall of rain on the 4th April. Towards the close of the latter month temperatures dropped and normal dry season conditions ensued with strong winds, but higher temperatures than those which helped to delay cotton ripening last year.

Native Food Crops.

Maize. A good maize harvest in 1936 had put an end to the severe food shortage which had prevailed for the few preceding months, and the crop was everywhere sufficient to allow normal living until the harvest just completed. At the beginning of last planting season natives were urged not to think of cotton to the exclusion of food crops, and gardens were generally of adequate size. As has been mentioned already, early rains, until the end of December, were insufficient and the maize which had mostly been planted in late November or early December, was slow in making its initial growth. Subsequently, the continuous rain and cloud of January and February hindered cultivation, leached the soil and generally retarded growth still further. However, in spite of these apparently unfavourable conditions most of the lake shore maize contrived to yield fairly well and only in part of the hills and foothills is some local shortage likely to occur. Locust damage has been considerably less than in 1935, and only in small, localised areas can they be said to have materially reduced the maize crop. In the Kota Kota foothills a beer tax has recently been imposed in order to conserve as much maize as possible for purely food purposes since the latter is likely to be somewhat short.

Cassava. As usual, the cassava crop is plentiful in all the northern areas where it is the staple food.

Millets. These are very little grown, and seldom occur except as occasional scattered plants of mapira in the maize gardens of the drier areas of the lake plain.

Beans and Groundnuts. The past two years have unfortunately been unsuitable for most of the high-protein food crops, and seed stocks for planting last rains were still below the average. This growing season has, however, been more suitable and fair quantities of beans and groundnuts are available for food purposes throughout most of the higher elevations and parts of the Dowa and Kota Kota lake plain. The incidence of Rosette disease was markedly low—perhaps on account of the high rainfall in January and February—and it is most gratifying to see that both groundnuts and beans are once again more plentiful, although the surplus for sale to outside areas is still small and most of the crop will be disposed of by internal sale and barter. Nthondo's area (Kota Kota) and the Dedza hills probably have a larger surplus of groundnuts and pulses than elsewhere, and will serve as central markets from which the surrounding, less fortunate areas may purchase.

Dates. At present this crop is grown on so small a scale as scarcely to justify inclusion in this report; but it is possible that it might later become of wider interest in the drier parts of the Bwanje valley and lake plain, in which it was recently noticed by Mr. Dent. There are at present seven palms at Esayia's village in the Bwanje valley and they are reported to have been planted about thirty years ago from seed obtained from Johannesburg. The palms have been in bearing for the part three years and several of them have, in addition, stout suckers of an age when they could be removed and transplanted elsewhere. It would seem that this experiment might be worth while in other villages in the low rainfall belt, wherever underground moisture promises to be adequate all the year round.

Cotton. After last year's disappointing yield, it was hoped that plentiful food and the memory of good prices would increase the interest in cotton and, given a good year, return the yields to the high level of 1935. This, however, is not to be.

Seed issue:—All seed was obtained from the African Export Corporation's ginnery at Salima and issue was made from 8 points in the district to a total of over 14,500 natives. The total weight of seed issued was 296½ tons, or an average of 45½ lbs per head. These figures are compared in the following table with those for last year, and it will at once be noticed that, although the individual weight of seed per head was almost the same in each year, yet a decrease of 500 issues lessened the weight of seed required by 10 tons.

District	No. of issues.		Wt. of seed		Wt. per issue	
	1936	1937	1936	1937	1936	1937.
Kota Kota ...	1,723	2,328	31 tons	43	40 lbs	41½
Dowa	4,596	3,638	90½ ,,	65¼	44 ,,	40¼
Dedza	6,334	5,907	137¼ ,,	139¼	49 ,,	53
Ncheu	2,400	2,670	48¾ ,,	49	45½ ,,	41
Total ...	15,053	14,543	307½ ,,	296½	45¾ ,,	45½

It will be recalled that last year, the second of cotton expansion, saw a doubling of the seed issue of the initial year. Since that original and general enthusiasm a large proportion of the lake shore Yaos of Dedza and Dowa have reverted to non-agricultural employment, and their decision is the chief cause of the decrease in this year's figures. Most other tribes have increased their number of growers and no disappointment need be felt for the decline in the actual weight of seed issued; the quantity per head is still sufficient to plant double the present average area of just under one acre.

Garden Census:—The cotton garden census finally showed a total of over 14,700 growers (including the 200 in the North Kota Kota area to be dealt with later in this report). It will be seen that, although the number of seed issues was lower than last year, yet the total growers shows an increase 1,700 due mainly to the fact that food shortage deterred many from planting the seed which they had received last year. This year's total is easily the highest recorded for the district so far, the previous totals for 1935 and 1936 being 13,145 and 12,933 respectively.

Planting:—The most pleasing feature of this year's cotton crop was the great response to a campaign designed to encourage earlier planting. In spite of the light planting rains in early December, nearly 70 per cent. of the total number of gardens was planted before the end of the month, and 88 per cent. before the end of the first week of January. In the preceding year only 34 per cent. of the crop was in the ground before the end of December and so there was every reason to hope that the 1937 crop had received a really good start in life. Abundant rain in January resulted in good germination and early growth; but when the heavy rain continued unabated into February, its hindering effect on cultivation and weeding became most marked. On many of the heavier alluvial soils such grasses as Pannicum Maximum were extremely difficult to eradicate and much of the cotton was drawn up by weeds and established very poor lower branches. At the end of February the rain slackened into a dry March, but the all-important early weeding had been too long delayed in many cases. However, in the dry March there was again good reason to hope for a strong set of flowers, and flowering did in fact begin very satisfactorily. But nowhere in the cotton area did the month's rain exceed two inches, and consequently conditions became too dry and flower shedding rapidly increasing.

Red boll-worm:—A further and more serious factor became apparent in early March in the shape of Red boll-worm. American boll-worm showed no increase over previous years; but the lateness of the 1936 harvest and the somewhat tardy uprooting allowed the sole host plant of Red boll-worm to continue until well on towards replanting time. As the result this season's crop will be reduced by about a third. The pest continued to increase from March onwards; bollshedding was abnormally high in consequence and most of the early crop failed to open properly. From another aspect, the present infestation of Red boll-worm can be regarded as a timely lesson on the great importance of early uprooting, and much of the work of the past four months has been devoted to instruction in the control of pests by this means.

Picking began in April and was accompanied by the usual instruction in grading, together with explanations of the system of "decontrolled markets," which were to be introduced for the first time this year.

Stainer:—The stainer invasion began on a very small scale in March, but no appreciable damage was done until the main influx early in May, when both baobab and ngoza fruits were dry and falling. However, by this time all the cotton had passed the first of its particularly vulnerable stages and there is no doubt that earlier planting is mainly responsible for the escape. From monthly observation made by all capitaos it was evident that baobab was the principal source of D. faciatus and Ngoza (Sterculia Africana) the chief source of D. Intermedius. The mtoo tree was frequently reported to be free from stainer, but its habit of continued fruiting over an extended period appeared to retain the stainer to some extent whenever they were found to be present.

Locusts:—In no case was any extensive damage done to cotton by locusts. Occasionally plants round the border of a garden were stripped by hoppers moving through the adjacent grass, and wherever gardens were foul with weeds, hoppers showed a greater tendency to migrate into them.

Later stages:—After heavy general rain on the 4th and 5th of April the rate of flowering increased somewhat and thereafter the normal dry weather followed, but with satisfactorily higher temperatures than those for the corresponding period last year, which so materially delayed the ripening of the crop.

Standard cotton grades, as determined by the buyers for exhibition to, and instruction of, growers were received about the middle of July and distributed to important centres throughout the district; but clearly it is essential that much of the grading instruction be completed before July, and the buyers could greatly assist by issuing the standard grades in May another year.

Estimates:—The boll-worm attack already referred to necessitated a reduction of the cotton yield estimates from 2,430 tons in April to 1,970 in early June.

Cotton in North Kota Kota:—On the recommendation of the Agricultural Officer, the Director of Agriculture sanctioned the extension of cotton to north Kota Kota as an experiment for one year. The area concerned extended from the Liwalazi river to Bana in Native Authority Kanyenda's section. Two tons of seed were issued at Bana to over 200 growers and planting took place for the most part in late January. The majority of the gardens were in tall Brachystegia country, which the Agricultural Officer had mistakenly believed suitable for the purpose. Fewer gardens were on the small areas of alluvium bordering the Liwalazi and Dwangwa rivers. Briefly, the experiment proved a failure and only the inadequate alluvium showed any capability of producing good cotton. The experiment is, therefore, to be discontinued after the sale of this year's crop at the end of August.

Groundnuts. Following two bad years, the area under groundnuts has increased this season as the native seed stocks have slowly revived; but the acreage must still be well below normal. As an economic crop little development has taken place this year apart from the ordering of 50 tons of imported seed for future expansion. The attempt to secure good, imported seed for planting last rains proved abortive, and the opportunity of establishing new strains when native seed stocks were low is now past. However, it is hoped that the natives in the areas for which seed has been ordered will take readily to groundnuts as an economic crop—partially for the reason that they have no alternative. With good seed, earlier and closer planting, rosette disease should be reduced and yields raised; and if the latter can be achieved there seems no reason why the crop should not bring a certain amount of cash and satisfaction to its cultivators. The price is never likely to be high; but returns of 30/- per acre should not be too difficult to obtain, and at the same time some benefit should result to the soil from the protection which the crop affords if correctly planted. Apart from the economic aspect, the high food value of groundnuts would seem to warrant their encouragement wherever they can be grown successfully, and good seed might later be distributed from the areas in which it is to be grown this coming season. Interplanted with maize, it does not entail extensive new clearing and it provides additional protection for the soil—particularly when the maize is in the early stages.

In order to prevent the slowly recovering protein foods from being exported in excessive quantities, the purchase of groundnuts has been restricted in certain areas this year. It is to be hoped that the native will not mistake this for a declining demand for groundnuts, and be disinclined later to buy the new imported seed. 50 tons of the latter have been ordered and, together with five tons from the Zomba Experimental Station and three tons from the Empire Cotton Growing Corporation, the proposed distribution is as follows:—

Dedza district	40	tons	(unshelled)
Dowa „	8	„	„
Kota Kota „	10	„	„

Castor seed. A demand for ten tons of castor seed late in 1936 is the only interest which has been shown in the economic aspect of the crop. Since then a few cwts. of good seed (originally obtained from the Zomba Experimental Station and multiplied at the E. C. G. C., and in school gardens) have been issued to natives in Mr. Miller's area. The crop is being encouraged to some extent as a hedge-row round cotton and maize; but, in the absence of any market, little progress is likely or justified, although the improved material is there for local multiplication when, and if, required.

Rice. This season has seen a most satisfactory expansion in the rice growing industry of Kota Kota, which is the only district in which the crop is of primary economic importance. The existence of an adequate market has been proved by the fact that the District Commissioner has secured orders for over 200 tons and, whilst this year's crop will fall some 50 tons short of the order, yet enthusiasm has been renewed and there is no reason to doubt that 300 tons could be produced and sold annually in the future. Ten varieties have been found in common cultivation, but Faya certainly exhibits a larger proportion of all the desirable features than any one of the others. It already constitutes about 50% of the total crop, and its extension is being strongly encouraged. This year's purchasers have expressed great satisfaction in its quality.

Agriculturally, improvement in yield could be secured by earlier planting of Faya (as a long-term rice), closer planting to increase the plant population, cleaner weeding and, finally, simple seed selection by the native growers. All these points are being emphasised in the field at present; but, since harvesting is performed by the women, the latter point is unlikely to receive much attention at present.

Recommendations have been made for a rice hulling machine and for a growers' co-operative society later; and a fuller report on these and other features of Kota Kota rice has been made already.

The Dowa rice crop in Maganga's and Makanjila's section is better than for several years past and it is likely than 20 to 30 tons may be sold locally to Indian traders.

Native Agriculture and Extension Work.

Apart from the advance which has been made in the methods of cultivating the economic crops already described, relatively little has been achieved towards stabilising native agriculture on sounder lines. It is true that a considerable amount of propaganda and instruction have been given concerning simple rotation and soil conservation as these problems occur in the cotton area, but progress is slow and the more important hill districts still remain untouched. The present importance of economic crops has kept the attention of all concerned on the lake shore and no supervision has yet been available for soil conservation work where it is most urgently required.

This year's progress towards early planting of cotton and the promise of early uprooting encourage one to believe that the main points of cotton growing are becoming more generally recognised and adopted. There has also been some progress with simple rotation of maize and cotton, although the present diverse size of their respective gardens complicates the establishment of a definite rotation in the European sense of the word. A further attempt towards rotation was made in January, when ¾ ton of pigeon pea seed from Makwapala was issued to Golomoti natives for planting in worn out maize gardens. Unfortunately, almost complete failure to germinate was reported by the Supervisor; but more attempts in the near future would be well worth while. In the absence of a restorative crop, which is at the same time of some cash value, it would seem that pigeon pea offers by far the greatest possibilities of maintaining soil fertility; and it is always likely that local natives might later acquire a liking for the crop as food.

In view of the better progress that has been made towards the establishment of cotton on sounder lines, it is possible that the Agricultural Officer might henceforward be able to devote more of his attention towards soil conservation in the more eroded parts of the hill country. The needs of such areas are too well known to require emphasis and it is suggested that work in the Dedza hills might combine protection of the soil and promotion of the groundnut industry.

The south Kota Kota foothills is the only area in which it has been possible to combine supervision of soil conservation work, where it is really needed, with the expansion of an economic crop (cotton). About 150 acres were contour-drained last dry season; but the very heavy rains of January and February sorely tried the new bunds and breaks were frequent. It would appear that bunds, without the help of roughly contoured maize ridges between them, are inadequate in such steeply-sloping country, and it is this change from matutu to ridges that natives seem so loath to make in their maize gardens. Very little difficulty has been experienced in getting cotton growers to plant cotton on ridges, which, though made by eye, follow the contour surprisingly well and the check which it has on soil erosion is most marked. Doubtless in time the same practice will be adopted with maize, if propaganda is continued, just as it is already in parts of the Dedza and Ncheu hills in the neighbourhood of Gomani's village.

Dowa demonstration plot. With the assistance of the District Commissioner, and an adequate supply of prison labour, a large plot was cleared in a prominent position near Dowa boma last year. Being on a slope the garden was properly bunded and both maize and beans were planted on the row system. The purpose of the various features was pointed out to a large meeting of chiefs and it is to be hoped that the various points may eventually take root in some of their minds as they repeatedly pass the plot in time to come.

School gardens. After three years' attempt to achieve some success with these institutions it is clear that the majority are doomed to failure and only a limited number should ever be chosen where the Supervisor is able to pay at least monthly visits and where the school teacher is more than average able and enthusiastic. The mission practice of making school holidays coincide with the main planting and growing periods means that labour is short in the most important months. Further, the common practice of absorbing cash profits for cotton, etc., into general school funds is not encouraging to those who work in the garden; and, without an unusually excellent teacher, results are most commonly disappointing.

The inevitable conclusion with regard to demonstration would appear to be that only plots under direct departmental control should be established—much as is already done by the Native Tobacco Board. The system may be slightly more costly, but the results would undoubtedly be more valuable.

Well sites. Following upon the 60-odd well sites that were selected for the development of dry areas in the Dedza lake plain and Bwanje valley in 1935-36, 18 more sites have been chosen this year in Dowa and South Kota Kota. The majority of them are in unoccupied alluvial belts, either between the main rivers or else on fertile seasonal streams. In each case the guiding principle has been to select sites whose surrounding soil is capable of maintaining a more or less permanent agriculture. The digging of these sites should be completed by the close of this dry season, and settlement should begin next year.

Bwanje valley development. With a view to establishing model communities in certain suitable areas, the Native Welfare Committee recommended that departmental co-operation should evolve and carry out a plan for the general social and agricultural development of a small section of the Bwanje valley. A group of four new well sites has been selected near Sharpe Vale as the area on which to work, and village sites are to be selected and demarcated by the District Commissioner and Medical Officer as a preliminary to general future development, which will, of course, include agriculture.

Locusts.

Flying swarms of redwing locusts made their first appearance in the Bwanje valley on December 5th, and later in the month other small swarms arrived in the Salima neighbourhood from the direction of the foothills. In both instances egg-laying took place, but the Ncheu swarm showed signs of having begun laying before arrival in the valley. On the whole, relatively little

damage was done even when swarms arrived in some concentration throughout January. Egg-laying was general and, although January and February were unusually wet months, the hatching of hoppers coincided with the arrival of an extensive dry period beginning with the last week of February. Consequently no fungus disease was reported and hopper development proceeded more or less unchecked except for somewhat spasmodic attempts to destroy them by the natives. Hopper movement was invariably westward and the scattered bands showed comparatively little tendency to unite, and not much damage was done. Flying, in a westerly direction, began in April and by May the district was clear except for external swarms travelling from Fort Johnston and Liwonde.

R. W. KETTLEWELL,
Agricultural Officer.

Zomba Experimental Station.

General. Routine work has been continued on the station as heretofore, with an increase in the acreage under Tung which now amounts to 13 acres, 3 of which are planted from the tree M13. Planting of all fields under the new layout was successfully carried out and the ridge terraces which have been laid out by means of an irrigation level have all worked satisfactorily. Advantage was taken of previous experience regarding spacing and size of ridge terraces and only small terraces at a ventical interval of between 2½-3 feet and with a fall of 1 in 360, combined with silt pits, were constructed. It may be said after our experience since 1926 on the station that the ridge terrace devised by Mr. M. L. Nichols of the Alabama Polytechnic Institute is generally more economical in construction and as efficient as the Mangum terrace in coping with abnormal soil erosion. That is to say when dealing particularly with the soils and average rainfall found over large areas of the Shire Highlands. Good use was made of planting various crops on the terraces for soil binding and strengthening and all of the Pennisetum spp. have been found to serve this purpose, besides being a useful windbreak. On the station more success is achieved with small terraces, accurately laid off and at correct ventical distance apart than the large broad base terrace. This system should appeal to natives who are constructing ridge terraces, as, after the initial labour is completed, the terrace is gradually built up year by year during the preparation and cultivation of the garden. Results regarding crop rotations, green manuring, and the application of compost to the station soil which is typical of a large area surrounding the station shows that compost has definitely played the greater part in restoring fertility to the soil. From observations on green manuring such as sunnhemp it has been found that, although ploughed under at the correct period, the plant does not break up and decompose readily and large pieces remain undecomposed throughout the dry season. It can now be advocated that green manures are better grown for their bulky vegetable matter and converted into compost, which is applied in a form readily available for plant growth, rather than that the green manure be dug in. The system of crop rotations, the growing of bulky material such as sunnhemp for converting into compost, and the return of the composted material to the field, is more likely to meet with success from native cultivators as it will be some time before the native grower will produce and dig in a large crop of greenmanure. It is proposed to start in the near future on gardens of selected growers where the results of ten years work on the station can be carried out to improve and retain the land in fertility, the correct method of terracing, rain watered compost, and the necessary attention that should be paid to cattle management in the hope that good food and economic crops can be grown with successful results.

Weather Conditions. The total rainfall for the season under review was 47.87 inches, the amount being 5.64 inches less than the previous season. Climatic conditions proved a favourable one for all crops, early rains in November making it possible to establish good stands, and the exceptionally good growing weather in December, combined with an even distribution of rainfall during the remainder of the season led to high yields of most crops.

Records of rainfall are :—

		Number of days on which rain fell.		Total rainfall for the month.	
		1936-1937	1935-1936	1936-1937	1935-1936
1936.	November	11	14	7.26	6.42
	December	15	13	5.85	8.01
1937.	January	23	17	18.02	5.31
	February	17	24	7.11	18.50
	March	10	31	2.07	10.08
	April	9	11	3.37	3.46
	May	2	3	.28	.51
	June	2	2	.87	.07
	July	6	5	.30	.12
	August	6	5	1.42	.11
	September	—	5	—	.03
	October	2	7	1.32	.89
		103	137	47.87	53.51

Crops.

Tobacco. Selection work was continued and measurements of a large number of plants were taken. A feature this season was made in harvesting and curing single plant selections separately, with the result that after examining the quality and shape of leaf the total number of selections was reduced to fifty eight, of which the majority were suited to the West African trade, the balance being of the Broad leaf type suitable for the United Kingdom. The crop, generally, was almost free from disease and this can be attributed to thorough and frequent spraying of seed beds, climatic conditions, and incessant control in the field; an interesting point in connection with selection work is that, by careful recording of measurements and field observations of single plant selections, a type suitable for the West African trade has been found and is now termed Narrow Leaf Western. Correct topping of this strain leads to a large percentage of leaf being suitable in texture and length for this specialised market.

Tung Oil: *Aleurites montana.* There was greatly increased interest in this crop and large numbers of prospective planters were shown over the plantation and given the results of over five years experimental work. The original trees are now 5½ years old and have made excellent growth and yielded heavy crops considering soil conditions. A total yield of 1678 lbs was produced and disposed of to planters but even so it was found impossible to cope with the large number of orders, many of which were for large amounts. A small outbreak of Aspidiotus latanial which appeared was completely kept in check by parasites and no control measures were therefore undertaken. All trees badly attacked by this scale the previous season have fully recovered and borne normal crops. 365 lbs of *A. Fordii* and 81 lbs of *A. montana* were received from the Forestry Department and disposed of.

Experiments dealing with the Chinese method of harvesting and fermenting of montana fruits were continued but it is clear that no elaborate preparation is required as the fruits naturally dehisce and fall to the ground in segments.

Soya Beans. All varieties produced high yields with the O-Too-Tan variety still constant at 2000 lbs per acre. From Field 8 where the above mentioned variety has been grown for six consecutive years a large quantity of inoculated soil was supplied to The British Central Africa Company for inoculation purposes.

Extensive trials were made on the cooking of soya beans in order to popularise this nutritious crop but unfortunately, although the final product was much appreciated, especially when a tenth portion of edible beans was added, the prolonged cooking and amount of firewood used was not in its favour. There are, however, definite indications from the number of seed issues to natives that they are gradually becoming accustomed to the new crop and that by cooking demonstrations the soya bean will eventually become the main source of nitrogenous material in a balanced diet.

Seed Issues. The number for the year was a record as these amounted to 1,334 issues to Europeans and natives. The total quantity of seed harvested for the year amounted to 42,611 lbs. being an average of over 7 cwt per acre.

The station buildings were used as a bulk depot for large quantities of imported groundnuts and cotton seed which was eventually issued to various sections in the Southern Province.

Due to the increase in number of native growers in the Southern Province 8,112 ozs. of Western tobacco seed were disinfected and distributed to various agricultural and Native Tobacco Board supervisors.

Cattle.

The herd was maintained in excellent condition throughout the year by rotational grazing on the slopes of Zomba mountain. Bush fires have been rigidly kept out for the past two years and good pasture grasses such as *Panicum maximum* are increasing. The herd was increased by four heifers and seven bull calves and as these are regularly dosed against internal parasites they have all made good progress. Large quantities of concentrates and succulent feeds were available during the dry season and general condition was maintained throughout the season, showing the effect of these feeds.

Surplus cows were disposed of to selected natives at a nominal figure but an effort will be made to follow up these issues to prevent beasts being sold at a profit and to see that the cattle are housed and properly fed.

Pasture Plots. Grasses on the station plots are now fully established and have made good progress, with the exception of *Pennisetum clandestinum* for which conditions are considered too dry for satisfactory growth. In palatability trials Paspalum urvellei and Paspalum dilatatum are well to the fore followed by Rhodes and Woolly Finger grasses. Slow progress has been made with the 500 acres of land in the Zomba mountain reserve but 25 acres of various grasses are now fully established under varying conditions. The whole of the planted area has been ridge terraced but no timber has been cut and this assists in conserving soil moisture during the dry season. Growth of grasses has been mainly good with Woolly Finger and Paspalum spp. exceptionally so, Pennisetum clandestinum the poorest of all. Plots established at present are all pure stands and now that these have been experimented with mixed pastures with a legume are to be aimed at.

Plant Importations.

The following were grown on the station under trial.

Spartinia Townsendii from the Principal, School of Agriculture, Chelmsford, Essex, seed failed to germinate.

Phaseolus spp. from Department of Agriculture, Burma Madagascar.

Butter Beans.

Selection Moki 27-30
,, Moki 32-40
,, Pegya
,, Pebyugale

} are all promising and should be retained as good reliable seed of Butter Beans is practically unobtainable in the country.

Seed wheat from Department of Agriculture, Southern Rhodesia.

Droop
Quality
Lalkarsirwali
Oainet

} Trials to be continued with but Zomba area not suited to production of seed wheat unless sown under irrigation.

Pasture Grasses from Department of Agriculture, Kenya.

Amphilophis pertusa
Panieum coloratum
Cenchrus ciliarns
Cynodon spp. C. Dactylon
Cynodon plecloslachyum 1.
Cynodon plecloslachyum 2.

} Most promising grasses, to be multiplied as quickly as possible.

From Research Station, Amani, Tanganyika.

Derris eliptica—cuttings have struck successfully.

Pithecolobinin dulce—seed of this hedge plant has germinated.

Pineapple varieties from South Africa. All doing well.

Compost Manufacture.

Three carts have been employed during the year on the collection of waste material throughout the Zomba Township area and the station. It is pleasing to record that over 400 tons of Indore compost were manufactured during the year under review and that this is a record of production for the station. Large quantities were issued free to native cultivators in the neighbourhood and that they are willing to carry compost some distance is a good criterion of actual results that have been seen on the station.

It is becoming more difficult to obtain, within economical working distance of the station, any additional quantity of bulky vegetable matter for converting into compost and the present output of 400 tons will most probably be the maximum output per annum.

Great interest was taken in the process by a number of visitors from Southern Rhodesia and other parts.

Buildings.

175,000 bricks were made and burnt and the following buildings completed.

Concrete threshing floor; 30 feet by 36 feet.

Cart Shed 12 feet by 30 feet for three pneumatic tyred carts.

Double Barn 24 feet by 60 feet with 5 tiers. One section of this building has a cement floor and can be used as a seed-store when not in use while curing. 494 yards of stone work drains were completed.

Due to pressure of work it was impossible to commence work on the compost factory and this and the new cattle sheds have been left over for the coming year. All buildings on the station were kept in good repair.

Miscellaneous.

Mr. L. Raynor commenced as Assistant in January and was in full charge of the station from August to December while the writer was on leave. Thanks are due to him for the programme of work which he carried out successfully during the absence of Mr. Cormack.

Botanic Gardens and Plant Introduction Station.

The usual routine duties and the collection of large quantities of trash and leaves were continued with. Rough timber was supplied to the Receiving Station, Zomba, and a small quantity of sawn timber was cut for the Auction Floor, Lilongwe.

Makwapala Sub-Station.

This station in future will be run as a sub-station from Zomba and was handed over by the Agricultural Officer during the month of August. The station has a special soil type and an effort will be made to restore fertility by rotations, the addition of compost, and fallow under bush or pigeon pea. The station will prove itself as an outlet for the production of seed of crops suited to the Lake shore area. Good crops of tobacco, groundnuts, cow peas, sim sim and millets have been grown in the past and selections of these will be continued with.

A. J. W. Hornby,

A. B. Cormack.

Lilongwe Experimental Station.

Table showing acreage under cultivation.

	Crops		Trees		Total
Likuni ...	80	...	23	...	103
Chimvua	44	...	3	...	47
					150 acres.

One 10 acre clearing has been opened bordering the main entrance road to Likuni on behalf of the Empire Cotton Growing Corporation. No further extension work was undertaken at Chimvua.

Work is in hand in connection with the erection of 3 cattle kolas at Likuni, and 2 at Chimvua, following the lines of those at Zomba Experimental Station.

Two pressed steel tanks of 5,000 gallons capacity each have arrived, one for each station. Brick platforms for same are being constructed and the pumping plant at Likuni is being covered in by a brick building. It only remains for the piping to arrive for the water supply at both stations to be completed.

Attention was given to the road from Likuni to Lilongwe via the aerodrome, and two new deviations, and one concrete invert were put in. Work continues on this road, and it is hoped to make it into an all weather one as it saves quite an appreciable mileage. The two new smallholders, one at Likuni and one at Chimvua, who were installed at the end of last season show much better promise than the previous occupants. Both had three acres under crops, and a further acre each is to be opened up this year. A record is being kept of produce and an analysis will be given at a later stage. Both holders applied compost to their maize and tobacco with gratifying results, but it is unfortunate that their monetary return on tobacco has not been as good as hoped, owing to the general depression in prices ruling this season. They are both making their own compost on the field stack principle, and have been of value in affording a visual demonstration to interested natives. No houses are to be attempted by them this season owing to their small returns from their produce.

The field stack method of compost manufacture practised on the station has not given as good results as last year due to the exceptional dryness of the season. It has been found that the harder material such as maize stalks has not broken down so well, but the resultant compost will still be available for application on the fields. Again, owing to the dryness of the season the field results are not as good as was hoped, but this was to be expected. It is sufficient to say that composted fields showed an improvement over control plots. The manufacture of kola compost continued. It is found that this method is inclined to be expensive, especially as the material has to be cut and collected. The most satisfactory compost is made from dry materials, and this would entail a considerable labour and expense collecting the material into large ricks before the rains break. Compost made of green grass is found to compact too tightly, and consequently does not break down satisfactory. It is regrettable to have to report that the station herd is not maintaining a satisfactory record. Since January, and up to the end of June, deaths show an increase of two head over births. Seven head died of what can only be surmised as food poisoning, and one heifer calf died of a skin complaint. Precautions were taken as regards grazing grounds, but one cow has had to be destroyed recently due to stomach trouble. The herd is under the examination of the District Veterinary Officer.

Most of the recent calves are of poor appearance, and are now undergoing a regular treatment for worms. The 3/4 bred Friesland bull maintains his condition and also his roaming proclivities. Young bullocks are being trained for farm work. Heifer calves predominate and most of the cows are averaging a calf a year. Two silage stacks—mixture maize and cowpea—were made this season as an experiment. To date the stacks have not been opened up, and their success or otherwise will be reported next year.

Enquiries were received from other districts as regards the possibilities of training a few men to act as general agricultural capitaos in the districts concerned. One or two mission boys also applied to be trained, and were taken on the staff. It is felt that to train natives thoroughly requires extra supervision and the inclusion of some kind of lectures in the syllabus. The method employed at this station was to detail the trainees to any special work, such as compost making, ploughing, milking, as well as ordinary manual labour, and to supply them with copies of Zokumbukira to enable them to study agricultural principles. Only one or two stayed the course. If this work is to be continued, then a native teacher is a necessity. He should be able to explain Zokumbukira in detail, and be attached to the trainees as capitao. The present system is unsatisfactory and it is hoped to devise other means, possibly following precedents set elsewhere, should the demand continue.

Natives from areas adjacent to the two stations were shown round during February and March, and seemed impressed with the visual effects of manured as against unmanured fields. It seems evident that the necessity for soil conservation is being brought home to some natives in their villages. This is a matter which is much stressed during these annual visits.

District Work.

Seasonal Notes. These continue to be read, but it is difficult to ascertain to what extent the precepts contained therein are put into practice. Varying reports are received from Supervisors. I am indebted to Father Lapointe of Likuni White Fathers Mission for his continued kind services as translator.

Village Demonstration Plots. Village demonstration plots were continued, and in the two areas of Nsaru and Lombadzi, which were the first to begin the plots, results should be striking as the plots were planted to the same crop. When the final reports are received from the Supervisors a report will be submitted.

Cattle Management. Not much headway has been made with regard to cattle management in the district. Only one area, Lombadzi, has reported any kolas being roofed in. The original milk vendors continue to flourish. One of them near this station has become an excellent mixed farmer, and affords an object lesson to many natives.

Manuring. The benefits of manuring are appreciated by most natives, and many manured their gardens whole or in part this season. It is unfortunate that the drop in tobacco prices will undoubtedly deter many natives from continuing this practice this year. They contend that their pecuniary reward is not commensurate with the labour entailed, and this is the crucial test for the average native. Many compost stacks were to be seen through the district but it was found that the native does not understand the principles of compost manufacture. On the other hand it is possible that the first flush of enthusiasm waned when it was discovered that the stack had to be attended to periodically. In practice the stacks were built up and in only a very few cases were they ever touched again. Propaganda continues.

Wheeled Transport. Owing to continued enquiries by natives for some sort of wheeled transport, a local firm was persuaded to order a trial consignment of steel wheels and axles. Unfortunately, the armament campaign intervened while the consignment was on order, and the present landed price is practically prohibitive. A few natives deposited money with me, and others did elsewhere, which goes to prove that the demand really is keen. Many more carts were seen operating during the tobacco buying season. Wheelbarrow wheels are also in limited demand.

Native Agricultural Shows. Two native agricultural shows were held in the Northern Province, one at Mkhoma, and one at Fort Manning. Both were well attended and the supply and quality of the exhibits were of a high order. Another show is to be held at Lilongwe in August. It is hoped that these shows will prove instructive, and will encourage the native to better his ways of living.

Seed Distribution. Seed distribution to natives was again poor, except for cassia seed which appears to be popular as a shade tree, and also for windbreaks. A bigger supply will be on hand this year. Soya, edible canna, millets, sweet potatoes, etc., were taken in very limited quantities. Free seed issues have been stressed in Zokumbukira and demand may be more brisk this season.

Conclusion.

Good propaganda work has been done by supervisors with varying success and is to be continued. Agricultural progress in this area is intimately connected with the tobacco industry, and it appears that the rate of progress fluctuates in keeping with it. The average native has yet to realize the principles governing this ceaseless propaganda, but there are signs that the more intelligent have grasped them and their success it is hoped, will encourage others to follow in their footsteps.

Plans for 1938.

One 10 acre field is to opened up at Likuni, completing the block opened up bordering the main entrance road to the station. No further extensions are contemplated at Chimvua.

Experimental Work 1936-37.

Drought conditions during March affected all crops in varying degree. All cereal, grain, and bean crops gave very poor yields, but the tobacco though shorter than usual was of good quality. The cotton crop which at one period looked as though it would give no yield at all, finally produced a moderate crop, but the staple was weak. Trial gardens are to be tried this coming season by a few selected natives round Likuni and Chimvua.

Potash Experiment with dark-fired tobacco, 4th year, Latin square.

Plot	Treatment lb per acre.			Yield per acre (green leaf.) lbs.
A.	Groundnut cake ...	300		
	Wood-ash. ...	200	...	4,490
B.	Wood-ash ...	300	...	4,405
C.	Muriate Potash ...	45	...	5,280
D.	Control		...	5,225

No differences are significant. This experiment is to be discontinued, as it has given a negative result every year.

No 1 Rotation Experiment, 4th year, Latin square.

Plot	Crop	Yield green leaf. lbs per acre.	Previous rotation.
A. ...	Tobacco ...	3,428 ...	Scrub 2 years : millet burnt
B. ...	do ...	3,957 ...	Sunnhemp : millet not burnt 2 years.
C. ...	do ...	3,808 ...	Groundnuts : maize + O.M. millet not burnt.
D. ...	do ...	4,286 ...	Pigeon pea 2 years : millet burnt.
E. ...	do ...	3,960 ...	Sunnhemp : millet burnt 2 years.
F. ...	do ...	2,970 ...	Pigeon pea 2 years : millet not burnt.
G. ...	do ...	2,860 ...	Scrub 2 years : millet not burnt.

Differences are significant,

E. B. C. D. are better than A. F. G.

A is better than F. G.

No 2 Rotation Experiment, 4th year, Latin square,

Plot	Crop	Yield green leaf lbs per acre.	Previous rotation.
A.	Tobacco	3,373	Bush fallow : tobacco : bush fallow.
B.	do	3,337	Control.
C.	do	3,293	Soya 2 years : tobacco.
D.	do	3,620	Sunnhemp : maize : tobacco.
E.	do	3,477	Pigeon per 2 years : maize + O.M.
F.	do	3,483	Cowpea : maize : tobacco.

No differences are significant.

Fertility Retention Experiment, 2nd year, Latin square.

Plot	Crop	Treatment	Yield per acre lbs.
A. ...	Maize ...	Control (Ridges) ...	4,128 (unshelled)
B. ...	do ...	Matutu ...	3,472 ,,
C. ...	do ...	Inter planted soya ...	4,428 ,,
D. ...	do ...	+Compost (5 tons per acre)	4,472 ,,
E. ...	do ...	+F. Y. M. (5 tons per acre)	5,084 ,,
F. ...	Tobacco	Rotation (Maize, groundnuts)	3,700 (green leaf)
G. ...	Soya	do (Maize)	414 (dry).

Differences are significant,

E. is better than A. B.

Remainder not significant.

White ants caused much damage to this block.

White soya variety trial, 2nd year, Latin square.

Plot	Variety	Yield per acre (shelled). lbs.
A.	Midwest	675
B.	Barberton yellow	495
C.	Herman	490
D.	Yellow mammoth	525

No differences are significant.

Fertility Retention Experiment, 2nd year, Latin square.

Plot	Crop	Treatment	Yield per acre lbs	
A.	Maize	Control (Ridges)	4,188	(unshelled)
B.	do	Matutu	3,292	,,
C.	do	Interplanted soya	3,312	,,
D.	do	+Compost (5 tons per acre)	4,388	,,
E.	do	+F. Y. M. (,, ,, ,,)	4,992	,,
F.	Tobacco	Rotation (Maize, groundnuts)	1,586	(green leaf)
G.	Soya	Rotation (Maize)	226	

Differences are significant,

D. E. are better than B. C.

Remainder not significant.

Dark fired tobacco variety trial, 2nd year, Latin square.

Plot	Variety	Yield per acre (green leaf) lbs.
A.	Western	1,670
B.	Turtlefoot	1,795
C.	Orinoco (Lizard tail)	1,315
D.	Orinoco (Narrow leal)	1,275

No differences are significant.

R. E. JACKSON.

Nyasaland Cotton Experiment Station, Domira Bay
Progress Report for the Season 1936-37.

By

H. C. Ducker, W. L. Miller and S. T. Hoyle.

Season.

The rainfall total for the season was 32.97 inches which is about the average for the Station. The total seasonal rainfall has not varied much since the Station was opened but the distribution has differed greatly from year to year. This distribution is probably the chief cause of variations of yield and, though it has never been so bad as to cause a complete crop failure, in not more than half the seasons can it be classed as "good". This year must be classed with the last two as "bad" In January there were 16 inches, nearly half of the above total, and only 1.5 inches in March. The result was that in the wet and sunless month of January growth was practically at a standstill, and in March there was not enough moisture for the crops fully to recover. The storm drains on the Station carried off much of the surplus water and mitigated the waterlogging in January. All except the flattest fields are ridge terraced and there was little erosion.

Cotton.

The strains of U.4 grown on the Station always make a good recovery after adverse conditions and, in spite of the uneven rainfall distribution, fair growth was made aided by some late rain in April.

It is possible that there would have been fairly good yields if it had not been for the very heavy attack of Red bollworm which is discussed below.

The cropping was exceedingly patchy and it was not uncommon to find small plots in a field yielding at the rate of 900 lbs. seed cotton per acre next to plots yielding 120 lbs. Part of this excessive unevenness can be ascribed to localised waterlogging and part to differential bollworm attack. But whatever the cause may have been, it meant, unfortunately, that little advance could be made in re-selection and not much reliance could be placed on the results of experiments. A reserve of seed of all selections was kept, but in most cases there is enough seed harvested for planting next season, and this will be supplemented from the reserve.

Z.14 seemed to attract more than its fair share of bollworms and did not do nearly as well as C.28 this year. The selections from N.7 have shown a definite improvement, and this will be put into the strain trials in the coming season. G. 5-79 from the Gatooma selections gave quite a good yield after looking as if its crop would be destroyed by jassid.

Of the other Gatooma cottons, G. 5-122 and G. 4-14 were quite fair, but the remainder were disappointing.

The best of the crosses was Harland's U. 4xCambodia backcross which gave excellent yields in places. The cottons with Gambia parentage, though of untidy habit, continue to show great cropping powers, though the lint still leaves much to be desired.

Cotton Experiments.—The cultivation experiment of last year was repeated, and the normal Station practice of light weeding gave a 25 per cent, increase over deep cultivation and the native practice of minimum weeding. The yields were very low, but they confirm last year's results.

The same result as last year was obtained with the spacing experiment, namely that $3' \times 2'$ leaving three plants per hole gave the best yield, but the difference between this and other spacings was not significant. A manurial trial in which ash from cotton trash and compost were used, gave no significant differences and the control actually gave a higher yield than either of the treatments.

Pests.

The outstanding feature of last season was the unexampled severity of the Red bollworm attack on the fields of the Station. The graph showing the bollworm population of all instars collected at random over the fields, shows the extent and severity of the attack. The damage done was extensive, and though not general throughout the cotton-growing areas of the country, could easily be matched in many places. At the Cotton Station the main source of the attack was traced to moths breeding in an area of native cotton in the vicinity which was not uprooted at the end of last season. The yields of the fields at the side of the Station closest to the stand-over cotton were about 100 lbs. seed cotton per acre, and the fields at the other end of the Station yielded from 300 to 460 lbs. seed cotton per acre.

There are no known alternative hosts of Red bollworm in Nyasaland, and as far as we now know, the problem of control lies in securing an effective close season, but this is not an easy matter in a country of peasant agriculture. In the first place there are isolated patches of cotton which may be up to two miles from the owner's village, and unless the owner wishes to disclose their whereabouts to visiting officials, they may easily go unnoticed. Even if all the gardens are located, there remains the poblem of effective uprooting in such a way that the plants are killed and ratoon growth impossible. Early in September an area of native cotton was visited where the uprooting was supposed to be complete. Ten plots, each one-tenth of an acre, were measured and it was found that there were 398 holes not cut out, and 1,661 holes where the plants had been cut at surface level and regrowth was possible. At a spacing of $3' \times 2'$ this is 5 per cent. and 23 per cent. respectively.

In November the same area was visited again, and a similar area measured in gardens which had been "cleaned" for planting and another in gardens which were to be abandoned. In the cleaned gardens there were 60 holes where the cotton had sprouted and 170 per acre in the abandoned gardens.

On the Cotton Station the uprooting was done under close supervision, but there was still an appreciable amount of re-growth. Most of this was from lateral roots, but one instance was recorded where the cotton had sprouted from a tap root which had been cut 8 inches below the surface of the soil. A cotton plant puller was made locally similar to the one used in India (Spotted Bollworms in S. Gujarat. Ind. Cent. Cotton Committee). This instrument worked well and quite quickly, and in $2\frac{1}{2}$ acres uprooted in this way there were no cases of re-growth. Another $2\frac{1}{2}$ acres adjacent and treated similarly, but uprooted in the normal way, had 29 cases of re-growth. These figures are enough to show that without the willing co-operation of the cultivator it is not easy to secure proper uprooting.

American bollworm was present in the numbers shown on the graph, but was not important compared with the Red bollworm.

Stainers were again recorded on the lines devised by the Pest Control Section at Barberton, and observations made on their wild host plants. Stainers moved into the cotton in February, and remained below 1,000 per acre until the begining of May when there was a rapid increase in the number of 5th instar nymphs and a less rapid increase in adults. By that time the bolls were fairly well advanced, and only the last of the crop received much damage from internal boll rot.

Two or three patches of cotton died out in the early part of the season and samples of the affected plants were sent to the Government Mycologist. Macrophomania phaseoli was identified on the specimens and observation will be made next season if there is any recurrence of the attack.

Rotation Crops.

The maize crop was affected by the early excess of rain and average yields of Potchefstroom Pearl were down to 2,100 lbs. per acre. On the other hand groundnuts did very well, and on ten acres there was an average of a ton of unshelled nuts per acre.

The maize time-of-planting experiment showed a progressive decrease in yield from the first planting at the break of the rains on 18th December. A week later showed little difference, but two weeks later showed a decline of 700 lbs. per acre. This has a bearing on the question of spacing out the maize planting to provide a longer period in which maize is attractive to the American bollworm moth. In the spacing experiment $3' \times 3'$ with one plant per hole yielded less than spacings with a higher number of plants per acre. Maize was planted on the site of last year's cotton manurial trial, but there was no residual response to the manures.

The native selected maize was tried against the Potchefstroom Pearl. There was a significant difference between the two, the native yielding 2,350 lbs. per acre, and the Potchefstroom 2,900 lbs. Further selections of the native maize have been made.

In the groundnut strain trial, the Barberton bunch was again better than the Station Virginia, Gambia and native varieties. A spacing of 18″×6″ was better than 3′×6″ but it is doubtful if the extra labour involved is worth the increase in yield obtained. The average yield for this experiment was 1,720 lbs. of shelled nuts per acre. In an experiment to test clean weeding against minimum cultivation, the former gave nearly twice the yield of the latter.

Sorghums did well, especially a short term variety from Swaziland, which gave a high yield and was most attractive in the field. Unfortunately this strain is very susceptible to weevil damage and it is difficult to store.

Of the beans grown, Bush Lima was a complete failure, but Green Gram did well yielding at the rate of 1,000 lbs. per acre. Soya beans were grown and the "Ami", Barberton Green and R.H.6 varieties did best, but there was difficulty in harvesting them.

Cattle.

Last year the start of an experiment in keeping cattle on the Cotton Station was reported and at the time of writing they were doing well. At the break of the rains the Tsetse fly population increase largely, and in spite of regular injections of Antimosan (Bayer) or antimony tartrate, five of the bullocks died from trypanosomiasis. At the end of the wet season there were only four beasts surviving and these in rather poor condition. It was then clear that in order to keep cattle on an economic basis, a greater degree of protection from Tsetse fly must be afforded. On the east of the Station the land has been kept free from bush fires with the co-operation of the local native chiefs, and in a year or two, the thicket growth should be sufficiently dense to prevent the approach of fly on to the Station. The main reservoir of Tsetse fly is to the west of the Station and the clearing begun last year was further extended but still more clearing is needed.

It was decided to try whether the remaining oxen could last through the dry season without treatment and the last injection was given in May. Their condition improved considerably, and in July a start was made in working them. Between July and November they have ploughed or ridged 40 acres and done other jobs of harrowing and carting. This is a much better record than was expected at the beginning of the dry season, and it gives cause for hope that with further measures of protection from fly, cattle may be kept on the Station without undue losses.

In October it was found necessary to restart injections which resulted in an immediate improvement in the condition of the bullocks. Blood smears were taken at regular intervals throughout the year and sent to the District Veterinary Officer for examination. Trypanosomes were found regularly in two of the bullocks and less regularly in the other two, so it is certain that these have a good degree of tolerance to infection.

Compost was made throughout the year, but with only four animals the tonnage was necessarily small.

Lilongwe.

The Experiment Station at Lilongwe had a season somewhat similar to that at the Domira Bay Station, but the excess of rain at the beginning of the season was not so marked. The site of the cotton plots was a well drained one and the plants were not much affected by the heavy rains in January, but the lack of rain in March restricted the growth of the plants and in this season it would have been advantageous to have used a closer spacing. The bolls opened well, but the final yields were not so good as last year. The strains of U.4 now grown on this Station are a great improvement on those of a few years ago, but they are not quite good enough to be considered a safe crop for the district.

The best strains in small bulk are two local selections, L.1 and L.33, and one from Gatooma, G.2-26, which all gave over 100 lbs. of lint per acre. Some of the other Gatooma strains were not far behind, but did not come up to the above yields.

Unfortunately, the best of the local selections have a rather short lint, and the best of the Gatooma cottons have a low ginning percentage; a satisfactory combination of the two is being sought. Further selections have been taken in both lots.

Stainers were counted in the fields and observations made on wild host plants. In the field D. fasciatus reached 1,000 per acre in mid-March and 3,000 in mid-April, and remained at about that figure until the middle of May when the numbers began to decline. D. intermedius did not reach the 1,000 mark until the middle of April and then rose to 2,000 at the end of the month when they remained constant for three weeks and then fell off rapidly. The early crop was quite fairly free from staining, and there was not much late crop to be affected by the rise in stainer population.

EUROPEAN AGRICULTURE.

Name of district.	Total acreage under cultivation. Acres.	Tobacco. Total. Acres under crop.	Tobacco. Total. Yield cwt.	Tobacco. *Fire-cured.* Acres under crop.	Tobacco. *Fire-cured.* Yield cwt.	Tobacco. *Flue-cured.* Acres under crop	Tobacco. *Flue-cured.* Yield cwt.	Tobacco. *Air-cured.* Acres under crop.	Tobacco. *Air-cured.* Yield cwt.	Tea. Acres under crop.	Tea. Yield cwt.	Coffee. Acres under crop.	Coffee. Yield cwt.
Lower Shire	2,977	10	40	...	...	...	...	*10*	*40*	...	...	...	...
Chikwawa	232	135	568	...	...	*125*	*518*	*10*	*50*	...	...	...	...
Central Shire ...	391	182	476	.	...	*182*	*476*	...	...	...	...	...	...
Cholo	16,698	1,403	6,049	*60*	*149*	*1,343*	*5,900*	...	...	8,251	77,638	47	80
Mlanje	14,713	719	1,603	*259*	*595*	*450*	*968*	*10*	*40*	8,861	51,528	75	60
Blantyre	5,735	1,355	5,830	*65*	*119*	*1,269*	*5,672*	*21*	*39*	...	...	180	197
Chiradzulu	1,594	23	72	*10*	*25*	*13*	*47*	...	...	...	...	3	...
Zomba	2,517	576	1,983	*16*	*35*	*550*	*1,926*	*10*	*22*	...	...	2	1
Upper Shire	222	75	324	*65*	*305*	*10*	*19*	...	...	...	...	...	...
South Nyasa	1,754	1,180	4,335	*120*	*595*	*990*	*3,590*	*70*	*150*	...	...	16	10
Ncheu	1,115	640	1,586	*323*	*972*	*202*	*440*	*115*	*174*	...	...	5	5
Dedza	328	150	438	...	...	*140*	*388*	*10*	*50*	...	...	1	2
Fort Manning ...	269	114	297	...	..	*27*	*108*	*87*	*189*	...	...	...	...
Lilongwe	3,533	300	633	*41*	*110*	*134*	*419*	*125*	*104*	...	...	1	3
Dowa	359	..	...	...	...	...	...	...	...	...	...	...	...
Kota Kota	39	...	...	...	...	...	...	...	...	...	...	1	1
Kasungu	10	...	...	...	...	...	...	...	...	...	...	...	...
Mzimba	190	...	...	...	...	...	...	...	...	...	...	150	86
West Nyasa	1,316	...	...	...	...		...	...	...	...	...	...	...
North Nyasa	103	...	...	...	...	...	...	...	...	...	...	85	65
Total ...	54,095	6,862	24,234	*959*	*2,905*	*5,435*	*20,471*	*468*	*858*	17,112	129,166	566	510

NOTE:—TEA: Acreage in plucking 1937 was 14,666. COFFEE: Acreage in bearing 1937 was 329½.

EUROPEAN AGRICULTURE—CONTINUED.

Name of district	Sisal. Acres under crop.	Sisal. Yield cwt.	Cotton. Acres under crop.	Cotton. Yield cwt. (lint)	Rubber. Acres under crop.	Rubber. Yield cwt.	Chillies and Capsicums. Acres under crop.	Chillies and Capsicums. Yield cwt.	Maize. Acres under crop.	Maize. Yield cwt.	Wheat. Acres under crop.	Wheat. Yield cwt.
Lower Shire	2,705	6,160	170	234	...	.	..	...	55	627	...	...
Chikwawa	...	...	45	38	...	...	...	...	35	502	.	...
Central Shire	...	...	...	...	...	...	...	...	33	519	...	...
Cholo	1,245	...	...	.	...	...	...	...	184	2,321	5	9
Mlanje	..		329	250	...	...	5	10	155	1,810	...	...
Blantyre	1	...	68	138	...	...	1	3	100	920	5	2
Chiradzulu	..	...	90	45	...	...	...	...	35	190	4	...
Zomba	1	...	5	5	...	...	..	...	69	859	...	...
Upper Shire	...	...	60	131	...	...	..	...	40	540	...	...
South Nyasa	...	...	...	...	..	...	...	...	100	1,500	...	...
Ncheu	...	...	9	97	...	...	...	...	88	139	12	42
Dedza	...	...	...	...	...	..	...	...	60	492	3	5
Fort Manning	...	...	...	...	...	...	...	...	10	150	...	...
Lilongwe	...	..	13	23	...	...	...	...	151	1,286	16	60
Dowa	...	...	60	45	...	...	...	...	27	52	5	20
Kota Kota	.	...	...	...	...	...	...	...	4	12	8	16
Kasungu	...	..	...	..	...	...	...	...	...	...	...	...
Mzimba		...	...	...		...	...	...	5	75	3	36
West Nyasa	..	...		.	1,300	1,685	...	...	15	400	.	...
North Nyasa	...		..	...		..	..	...	8	120	...	...
Total ...	3,952	6,160	949	1,006	1,300	1,685	6	13	1,174	12,514	61	190

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	Legumes.							Oil Seeds.					
	Total.		*For food.*		*For fodder*		*For green manure*	Total.		*For crushing.*		*For food.*	
	Acres under crop.	Yield cwt.	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	Acres under crop.	Yield cwt.	*Acres under crop.*	*Yield cwt.*	*Acres under crop.*	*Yield cwt.*
Lower Shire	9	56	*9*	*56*	...	...	...	3	27	...	...	*3*	*27*
Chikwawa	3	6	*3*	*6*	...	...	...	...	...	...	...	...	...
Central Shire	74	169	*17*	*169*	...	...	*57*	6	13	...	...	*6*	*13*
Cholo	344	8,101	*79*	*6,951*	*12*	*1,150*	*253*	24	70	*20*	*45*	*4*	*25*
Mlanje	1,304	418	*100*	*322*	*25*	*96*	*1,179*	...	...	...	...	...	...
Blantyre	386	1,518	*77*	*1,478*	*64*	*40*	*245*	24	41	*1*	...	*23*	*41*
Chiradzulu	186	25	*11*	*25*	*66*	...	*109*	4	40	...	...	*4*	*40*
Zomba	656	475	*97*	*345*	*137*	*130*	*422*	24	114	*12*	*70*	*12*	*44*
Upper Shire	25	...	...	...	...	...	*25*	2	5	...	...	*2*	*5*
South Nyasa	170	...	*30*	...	...	...	*140*	...	...	...	...	...	...
Ncheu	64	165	*9*	*165*	*4*	...	*51*	12	22	*10*	*20*	*2*	*2*
Dedza	15	57	*15*	*57*	...	...	...	1	...	...	...	*1*	...
Fort Manning	32	...	*10*	...	...	...	*22*	6	...	...	...	*6*	...
Lilongwe	478	217	*70*	*217*	*11*	...	*397*	6	26	*3*	*15*	*3*	*11*
Dowa	20	19	*4*	*19*	...	...	*16*	16	158	...	...	*16*	*158*
Kota Kota	1	2	...	...	*1*	*2*	...	...	...	...	...	...	...
Kasungu	2	1	*2*	*1*	...	...	...	...	...	...	...	...	...
Mzimba	8	75	*8*	*75*	...	..	...	2	3	...	...	*2*	*3*
West Nyasa	...	...	...	...	...	...	...	1	20	...	...	*1*	*20*
North Nyasa	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	3,777	11,304	*541*	*9,886*	*320*	*1,418*	*2,916*	131	539	*46*	*150*	*85*	*389*

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	Tung Oil.		Fruit Trees.		Nut-Bearing Trees.		Miscellaneous.		Woodland Artificially Established
	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres.
Lower Shire	...	...	3	...	...	...	...	...	22
Chikwawa	...	...	7	16	...	...	...	...	7
Central Shire	...	...	14	255	...	...	...	...	82
Cholo	845	20	91	8	...	...	9	20	4,250
Mlanje	759	4,330	448	...	...	...	...	...	2,423
Blantyre	7	...	15	3	...	...	...	...	3,593
Chiradzulu	20	..	28	...	...	...	...	...	1,201
Zomba	32	14	12	...	...	...	1	8	1,139
Upper Shire	...	...	2	...	...	...	...	...	18
South Nyasa	...	...	...	...	...	...	...	...	288
Ncheu	...	...	19	...	...	...	...	...	266
Dedza	...	...	22	133	...	...	...	...	76
Fort Manning	...	...	10	...	20	...	...	...	77
Lilongwe	14	...	23	110	...	...	...	...	2,531
Dowa	...	...	4	...	...	...	...	...	227
Kota Kota	...	...	2	10	...	...	...	...	23
Kasungu	...	...	3	...	...	...	...	...	5
Mzimba	...	...	...	...	...	...	...	...	22
West Nyasa	...	...	...	...	...	...	...	...	...
North Nyasa	...	...	...	...	...	...	...	...	10
Total ..	1,677	4,364	703	535	20	...	10	28	16,260

NATIVE AGRICULTURE.

District.	Seed Cotton	Rice	Wheat	Ground-nuts	Tobacco	Maize	Peas and Beans
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Lower Shire ...	2,123				...		
Chikwawa ...	1,167				...		
Central Shire ...	416				...		
Cholo ...	335				21		
Mlanje ...	68				633		
Blantyre ...	110				217		
Chiradzulu ...	...				570		
Zomba ...	...				361		
Upper Shire ...	161				30		
South Nyasa ...	105				...		
Ncheu ...	330				149		
Dedza ...	456				36		
Fort Manning ...	...				241		
Lilongwe ...	...				3,166		
Dowa ...	691				1,149		
Kota Kota ...	402				...		
Kasungu ..	...				9		
Mzimba ...	...				...		
West Nyasa ...	...				...		
North Nyasa ...	227				...		
Total	6,591				6,582		

NATIVE LIVE STOCK.

District.	Cattle.	Sheep.	Goats.	Pigs.
Lower Shire	280	2,365	9,529	12,609
Chikwawa	176	1,521	7,947	9,067
Central Shire	1,256	689	5,973	503
Cholo	150	1,865	6,258	6,627
Mlanje	547	2,980	13,338	10,016
Blantyre	2,903	3,700	9,327	5,786
Chiradzulu	2,597	956	7,367	7,756
Zomba	1,254	899	1,296	311
Upper Shire	100	3,250	7,800	350
South Nyasa	417	3,716	6,319	67
Ncheu	15,059	2,483	11,373	879
Dedza	26,868	3,317	31,128	411
Fort Manning	2,170	3,480	8,760	4,060
Lilongwe	41,000	6,400	49,000	3,400
Dowa	18,380	8,500	39,000	5,000
Kota Kota	2,900	2,500	11,050	2,600
Kasungu	1,523	1,063	1,549	202
Mzimba	60,000	5,000	20,000	200
West Nyasa	2,192	136	1,105	—
North Nyasa	38,690	345	1,875	22
Total	218,462	55,165	249,994	69,866

*1936 figures;

LIVE STOCK OWNED BY EUROPEANS AT 31ST DECEMBER, 1937.

District.	Cows and heifers.	Bulls.	Oxen.	Calves.	Pedigree cattle.	Horses.	Mules.	Donkeys.	Sheep.	Goats.	Pigs.
Lower Shire	1,016	17	239	304	41	...	...	22	98	101	75
Chikwawa	217	10	31	120	...	...	...	...	...	...	...
Central Shire	23	4	12	19	...	...	...	9	...	...	14
Cholo	1,319	36	711	484	6	36	...	13	265	47	118
Mlanje	400	9	428	235	3	...	...	...	4	...	...
Blantyre	1,059	27	503	508	32	11	...	7	21	20	108
Chiradzulu	678	12	331	337	12	2	...	2	...	19	78
Zomba	1,260	18	482	308	7	8	...	20	138	24	34
Upper Shire	8	1	3	5	...	...	...	...	20	44	31
South Nyasa	129	2	26	39	...	...	...	...	28	66	9
Ncheu	329	13	172	113	1	...	...	16	135	10	171
Dedza	328	10	206	186	8	...	...	34	67	12	72
Fort Manning	87	3	65	35	...	...	...	..	44	...	18
Lilongwe	301	14	351	110	...	...	...	32	69	48	196
Dowa	13	1	18	4	...	...	...	3	98	13	6
Kota Kota	1	16	38	17	1	...	...	2	31	...	...
Kasungu	...	...	...	...	...	...	...	...	...	1	18
Mzimba	6	..	49	5	...	...	...	5	1	...	...
West Nyasa	14	1	9	4	...	...	...	...	2	...	21
North Nyasa	86	4	67	43	...	...	...	...	69	...	50
Total ...	7,274	198	3,741	3,376	111	56	...	166	1,090	405	1019

Native Tobacco Board.

Appendix K.

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDING 31ST DECEMBER, 1937.

RECEIPTS

BALANCE BROUGHT FORWARD FROM 1936		£19,112	14 9
Revenue			
Tobacco Tax	£13,177 10 0		
Sale of Tobacco Seed to Natives	2,606 18 0		
Sale of Tobacco Seed to Europeans ...	31 7 6		
Sale of Tobacco Leaf ...	130 16 8		
Sale of Miscellaneous Seeds and Plants ...	9 1 7		
Sale of Tobacco Booklet ...	3 15 3		
Sale of Plants and Gardens Booklet	1 5 9		
Interest on Fixed Deposits	180 0 0		
Miscellaneous Receipts ...	33 12 0		
Sale of Tobacco Plants to Natives	1 6 3		
Sale of Bush Cars ...	67 0 0		
TOTAL REVENUE		16,242	13 0
CONTRIBUTION BY NYASALAND GOVERNMENT TOWARDS COST OF SUPERVISORS		720	0 0
BALANCES RETURNED		607	18 5
BALANCE DUE TO TREASURY ...		366	3 5
Carried forward		£37,049	9 7

PAYMENTS

BALANCE DUE TO TREASURY BROUGHT FORWARD FROM 1936				£591 18 8
Personal Emoluments: European Staff				
Agent and Senior Supervisor, £600 for six months, £700 for six months ...	£650 0 0			
Agricultural Superintendent, £400 for ten years then £500	366 13 4			
Eight Supervisors, £400 for ten years then £500	3,283 17 9			
Two Supervisors, £400	566 13 4			
Two Junior Supervisors, £186 by £15 to £246 by £18 to £300	292 0 0			
Eight Temporary Supervisors, £360 ...	1,674 16 9			
Allowance to Officer-in-charge, Lilongwe Experimental Station	50 0 0			
Two Temporary Clerks, one @ £300 one @ £180	115 4 4			
Acting Allowance	30 13 4	£7,029	18 10	
Native Staff				
Fourteen Clerks, rates and periods variable, £6 to £27	97 12 5			
Two hundred and forty-two Capitaos, rates and periods variable, £6 to £18	2,031 18 5			
Six Messengers, rates variable £4 16/- to £7 4/-	24 6 0			
Eleven Watchmen, rates variable £4 16/- to £5 2/-	37 12 4	£2,191	9 2	
TOTAL PERSONAL EMOLUMENTS				£9,221 8 0
Other Charges				
Travelling		1,656	8 4	
Passages		433	11 3	
Buildings, Lilongwe—Upkeep of		7	0 8	
Buildings, Zomba Experimental Station Upkeep of		10	12 1	
Buildings, Lilongwe Experimental Station Upkeep of		11	19 4	
Seed and Experimental Plots, Mtiti		38	8 0	
Seed and Experimental Plots, Capitaos ...		32	0 0	
Lilongwe Experimental Station		505	8 1	
Stationery and Printing		368	17 11	
Implements and Equipment		72	7 0	
Incidentals		21	13 4	
Uniforms		129	14 2	
Camp Equipment		4	4 6	
Sanitation, Fort Manning		7	9 0	
District Experimental Work		70	10 11	
Tobacco Nurseries		53	16 4	
Miscellaneous transport of Board's & Employees' effects		15	11 9	
TOTAL OTHER CHARGES				£3,439 12 8
Contributions				
Zomba Experimental Station		392	8 4	
Nyasaland Government, Clerical Assistance ...		359	15 0	
Forestry		91	18 11	
Native Agricultural Show, Lilongwe ...		25	0 0	
King George V. Memorial Fund		25	0 0	
European Hospital, Lilongwe		50	0 0	
TOTAL CONTRIBUTIONS				944 2 3
Central Buying Stations: Northern Province				
Permanent Station Hands		21	10 7	
Sanitation Pits		22	1 6	
Erection, Enlargement, Repairs and Clearing ...		56	2 7	
Sanitary Police		4	2 9	
Sanitary Labourers		8	15 3	
Zomba				
Permanent Station Hands		1	3 4	
Repairs and Clearing		10	10 8	
TOTAL CENTRAL BUYING STATIONS ...				124 6 8
Special Expenditure				
Eight Latrines		17	2 9	
Agent's Office, Additions to		41	3 9	
Buildings, Zomba Experimental Station:				
(*a*) Threshing Floor		39	16 9	
(*b*) Curing Barn		18	19 5	
Tents		66	11 6	
Pedal Cycles		66	10 0	
Secretary's House, Additions to		146	10 11	
Farm Cart		29	7 6	
Allowance to Mr. Bartlett towards cost of housing ...		30	0 0	
House for Supervisor, Zomba district ...		256	3 6	
Five Houses, Zomba Experimental Station and Lilongwe area		2,024	3 1	
Buildings, Lilongwe Experimental Station, Two Water Tanks and Two Pump Houses ...		224	14 11	
Bore-holes		800	0 0	
TOTAL SPECIAL EXPENDITURE				3,761 4 1
Carried forward ...				£18,082 12 4

Native Tobacco Board (*Continued*).

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDING 31ST DECEMBER, 1937.

RECEIPTS			PAYMENTS			
BROUGHT FORWARD		£37,049 9 7	BROUGHT FORWARD			£18,082 12 4
			Marketing of Native Trust Land Tobacco Receiving Stations			
			Temporary Employee, European ...	£59 6 1		
			Temporary Employee, European, Travelling	3 3 0		
			Temporary Employees, Native ...	219 8 7		
			Buildings, Equipment and Material ...	741 7 6		
					1,023 5 2	
			Auction Floor			
			Temporary Building Employees ...	140 4 3		
			Travelling	31 16 0		
			Material	2,991 19 7		
			Labour	244 13 11		
					3,408 13 9	
			TOTAL MARKETING OF NATIVE TRUST LAND TOBACCO			4,431 18 11
			TOTAL EXPENDITURE			22,514 11 3
			ADVANCES MADE			1,101 12 9
			BALANCES CARRIED FORWARD TO 1938			
			Current Account at Bank		9,433 5 7	
			Fixed Deposits at Bank		4,000 0 0	13,433 5 7
		£37,049 9 7				£37,049 9 7